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How Milling Machine Service Has Helped Manufacturers

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Editor, *American Machinist*

Securing high production from standard machines by the use of special fixtures—Utilizing engineers of wide experience to improve milling methods in varied industries

THOSE who recall the days when the milling machine was struggling for recognition as a machine for cutting metal, particularly flat surfaces, cannot help being deeply impressed with the position it has now assumed in machine production. This is especially true of the automotive and other important industries. The change from being a new method which had to beg a chance to prove its worth, to a recognized standard has not, however, been a matter of either chance or of waiting until its merits were recognized, but is rather largely the result of an aggressive policy on the part of some of the best known milling machine builders.

MANY still fail to realize what has been accomplished by milling, in the reduction of production costs. This article shows how a consulting service, inaugurated for the benefit of users of milling machines, has been employed advantageously in many lines of work. It also shows how standard machines of various types can be adapted to production jobs by the use of special fixtures, without preventing their use on other work on comparatively short notice.

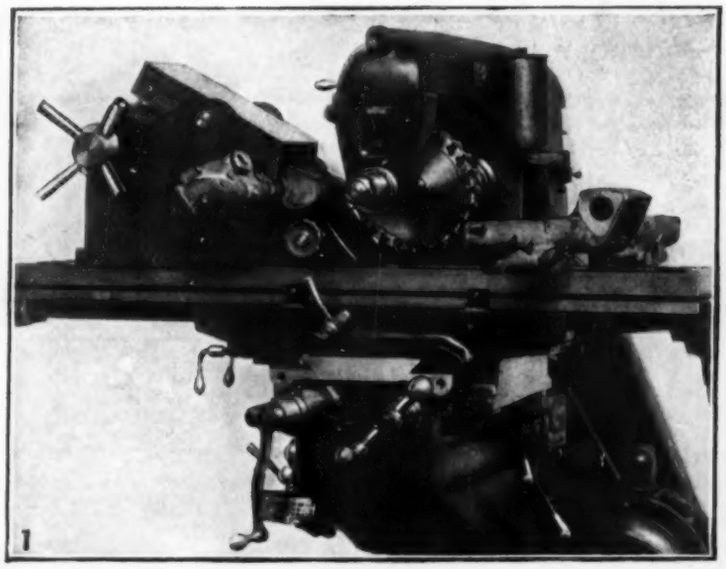
Having always specialized in building milling machines, the Cincinnati Milling Machine Co. years ago established a special service which provided for the study of the problems of manufacturers and suggested fixtures and methods by which the parts could be milled. This practice differed from what had previously been considered as "service," which consisted in looking after machines already in use. It was really a consulting engineering service in which the wide experience of the company's engineers was placed at the disposal of the customers.

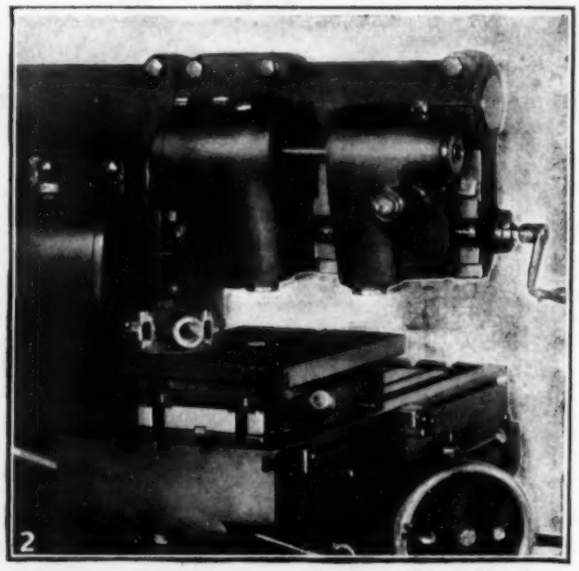
Some interesting milling developments resulting from this practice will be illustrated herewith. As a number of the examples show the use of the automatic type of milling machine, which is still new to many who use the older type of machine, a brief explanation of its advantages is in order. Where large quantities of similar parts are to be surfaced these automatic machines can be tooled for almost continuous production, and conserve the operators by eliminating all but the labor of chucking and removing the work. They are not, however, single purpose machines, as they can be readily tooled to handle a large variety of work. One convenient feature is the maintaining of the table of the machines at a height of 34 in. from the floor on machines of all sizes, which makes it easy to handle the work on and off the machines.

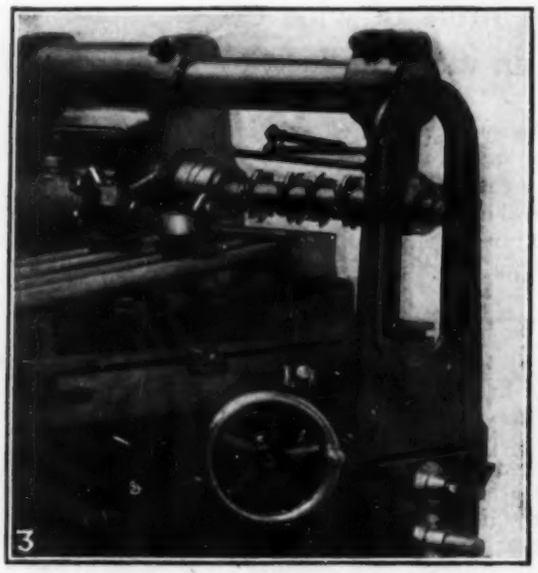
When properly set the table advances automatically to the work at high speed, from 100 to 150 in. per min. On reaching the work a dog throws in the regular feed without attention, and later automatically returns the table at high speed to the starting point. Or the dog can be set to run the work clear of the cutter and stop the table for removing the work, after which the table can be returned at high speed. Or dogs can be set to give intermittently fast and slow movements for milling a string of pieces which must have space between them. In this way the table jumps the gaps between cut surfaces at 100 to 150 in. per min., practically eliminating lost time. There are many variations of these cycles to suit different conditions.

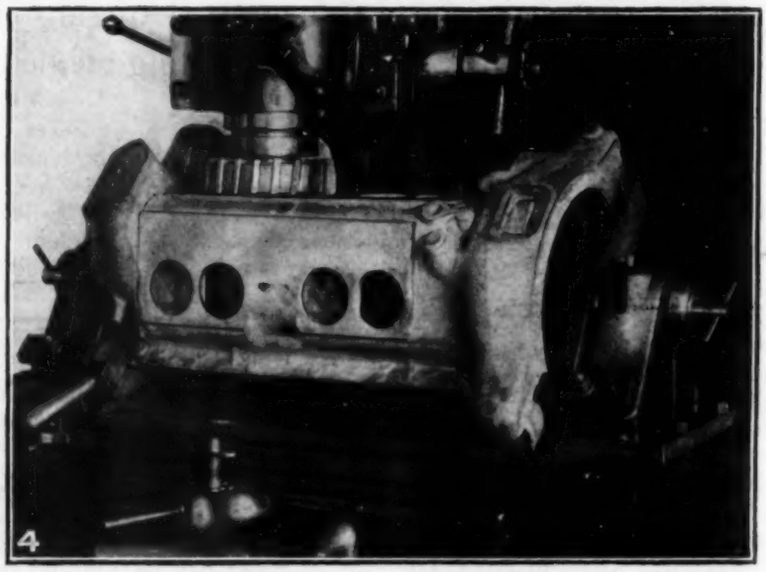
It might perhaps be said that the best milling machine is no better than its fixture, and here is where the service idea is of particular value. For while there are comparatively few distinct types of fixture, the adaptation of ideas from many lines of work enables the service engineer to select the best type and to modify it to suit the conditions of the particular job.

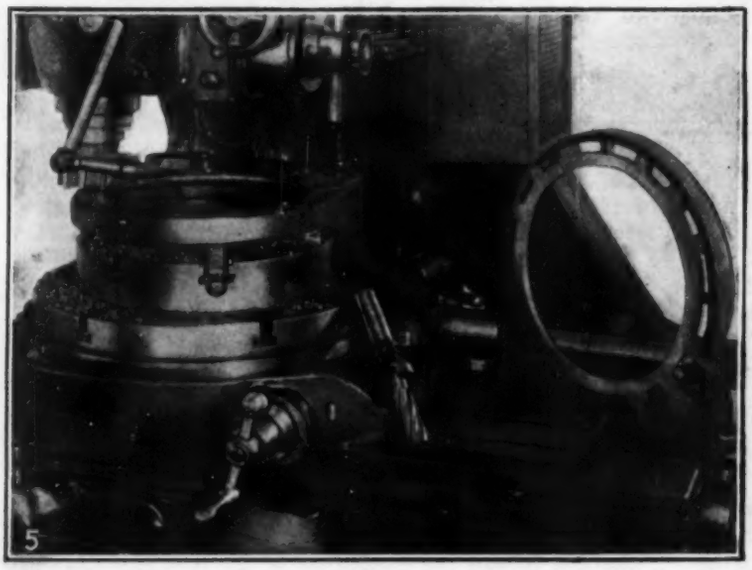
It will be noted that the indexing or revolving base is used in many cases for handling a large variety of











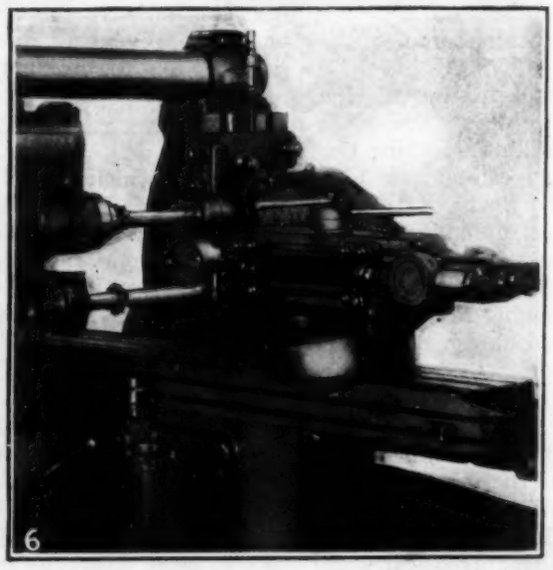
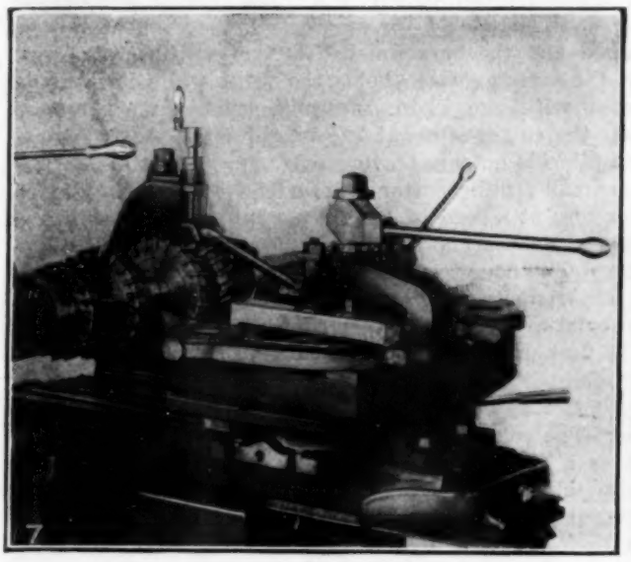
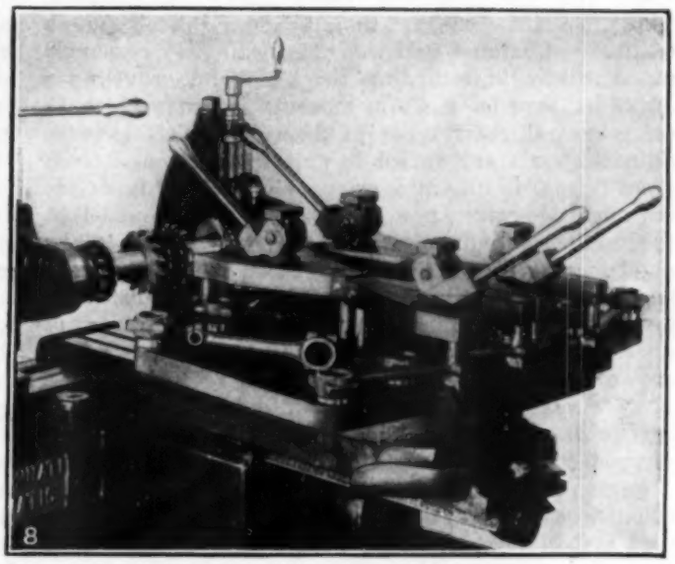
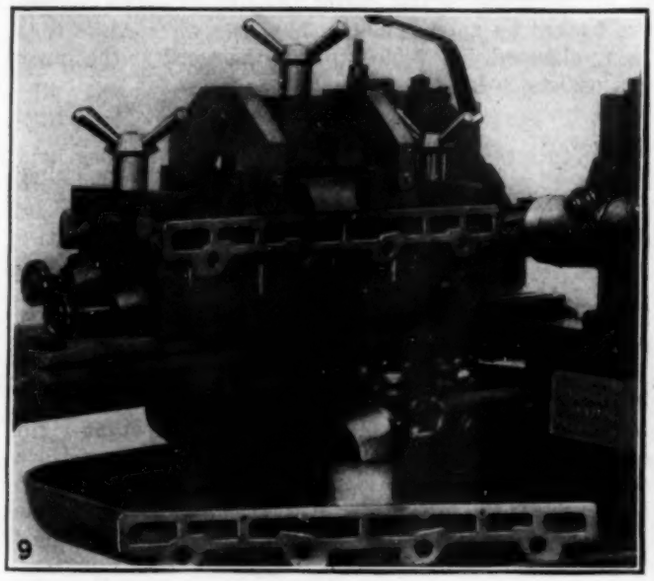
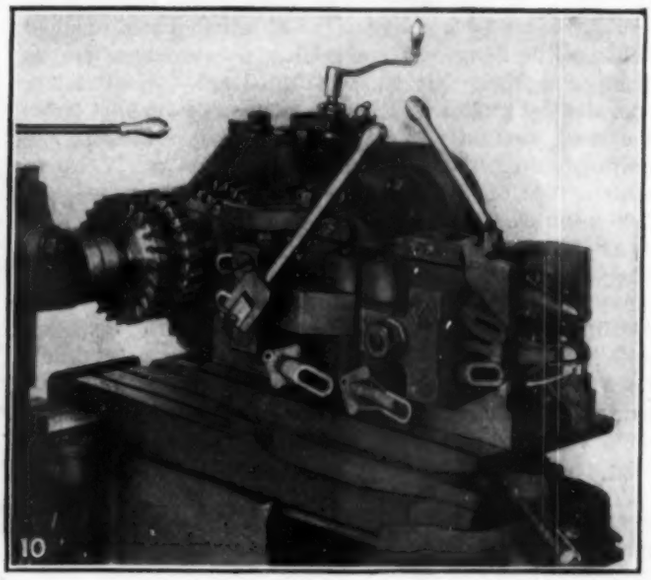


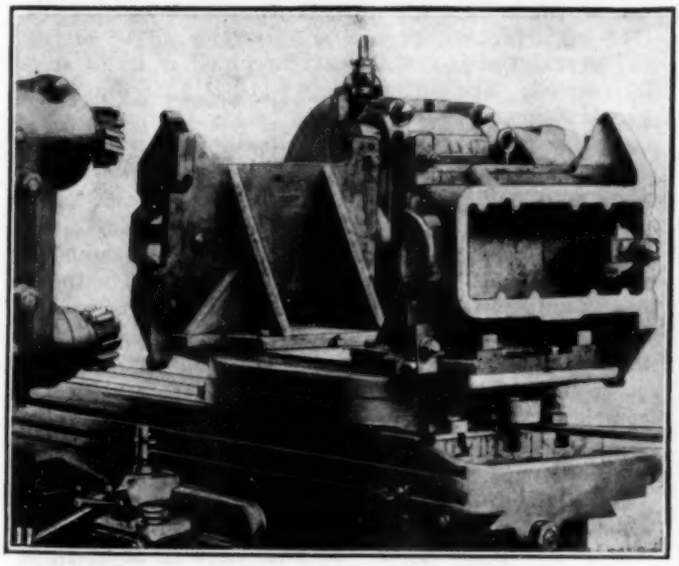
Fig. 1—Milling exhaust manifolds. Fig. 2—Two vertical spindles on plain miller. Fig. 3—Simple keyway cutting fixture. Fig. 4—Milling 8-cylinder crankcase. Fig. 5—Facing and boring motor brackets. Fig. 6—Double spindle automatic











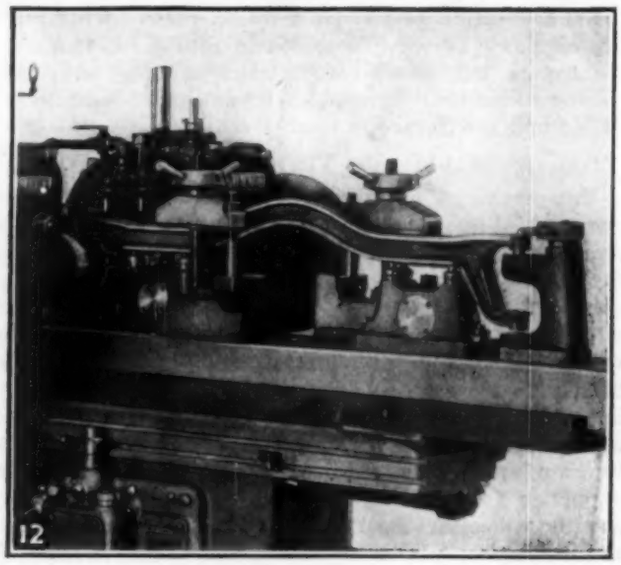


Fig. 7—Index base and fixtures for chain cases. Fig. 8—Slotting rods for piston pins. Fig. 9—Facing exhaust manifold. Fig. 10—Surfacing two sides at once. Fig. 11—Using 3 milling spindles. Fig. 12—Fixture for front axles

work and that standard bases have been adopted. While it might seem that their use would involve a loss of time it is stated that the time ordinarily consumed automatically in returning the table and swiveling a 16x36-in. base on a 48-in. machine is from 12 to 15 sec. Several other types of fixtures are also shown. Spindle speeds are varied to suit the work and feeds from 1 to 40 in. per min. are provided. Fast feeds are recommended where possible as it has been found that the dulling of cutters is in direct proportion to the number of contacts the cutter tooth makes with the work in a given length of travel. Cutter lubrication and cooling are furnished by a pump having a capacity up to 12 gal. per min. The other types of machines shown are better known and need no special mention. A wide variety of work is shown indicating that the service has been taken advantage of by manufacturers of products in many lines.

Beginning with the milling of a side surface on an exhaust manifold, Fig. 1 shows a 2-M plain machine with a special fixture on the table which holds the piece cross-wise of the table. The work rests in an angle and is located by a stud and a half-stud in two finished holes in the flange. It rests on a finished base and is clamped against this base by the large forked clamp, operated by a pilot wheel. An adjustable support holds the work against the cut. The piece is cast-iron, the milling cutter 10 in. in diam. and runs at 27 r.p.m. with a feed of 7⅜ in. per min. The time per piece is 1.05 minutes.

An 18-in. plain manufacturing machine is shown in Fig. 2 with a special double spindle vertical attachment for milling guide slots in valve seats. The outer spindle is adjustable to handle valves of different sizes, and is supported on the overarm. The other spindle head clamps to the face of the column and to the overarm. The work is held in a special fixture, not shown, at each end of the index base. Two 3-in. slotting cutters are used. The valve is of brass, the cutters run 700 r.p.m. and the feed is 0.037 in. per rev. The whole attachment can be removed quickly, leaving a standard machine for any work desired. This method increased production 50 per cent.

An adaptation of the plain 18-in. machine for milling rear axle keyways is shown in Fig. 3. It is a simple fixture but handles four axles at once with two clamping handles. It enables 60 axles per hour to be milled and the fixture is readily removable.

Examples of Vertical Milling

Two examples of milling on vertical machines are shown in Figs. 4 and 5. The first is an aluminum crankcase for an eight-cylinder motor being surfaced for the cylinders on a No. 4 high-power vertical machine. A special indexing cradle holds the case on the oil-pan surface which has been milled previously. The work is lined up by tongues fitting into the finished bearing-cap seats. A loose bar put through the finished camshaft hole is pulled down by eye bolts and clamps the work rigidly in place. The cutter is 9½ in. in diam. and has inserted blades. It is mounted on an extension from the spindle so that the wings on the casting will clear the machine. Both cross and longitudinal feeds are used and after one surface is finished, the cradle is indexed 90 deg. and the other cylinder face is machined. The cut is about ⅛ in. and the feed 28.4 in. per min. The cutter runs 128 r.p.m. and the time per piece is 9.85 minutes.

There is shown in Fig. 5 a No. 4 vertical at work on a cast-steel bracket for an electric motor. The face is milled and the bore finished at one setting. A chuck on the circular table holds the work while it is being faced with the 7½-in. face-milling cutter. The feed past the cutter is about 12½ in. per min. After facing, the table is quickly traversed by power to the left and the small milling cutter is inserted. It is used to finish the bore at a feed of 14¾ in. per min. The bore is 14½ in. and the casting about 20 in. across the largest diameter. The floor to floor time is about 9½ minutes.

The remaining examples show the adaptation of the automatic type of milling machine to a variety of work. The first, Fig. 6, is a 48-in. machine, milling guide slots in a cast-iron valve, removing from 1/16 to 3/16 in. of stock with two 3½-in. alternate-toothed cutters on each spindle. The valve disks are held between centers in pairs, at each end of the indexing fixture. The centers are adjustable for different sizes, from 2 to 8 in. The disks are squared by blocks actuated by one small hand-wheel at each end and are clamped by end pressure exerted by strap clamps at the end of the fixture. The centers are backed by springs which hold the work while it is being clamped. A V-block under the work at the inner end assists in locating the work.

Cutter Details

The cutters have 12 teeth, are undercut 10 deg. and have a 15-deg. spiral. Both upper and lower slots are cut at one pass. Each gang of cutters is supported by an outboard bearing which is special. There are two levers on top of the fixture, one for withdrawing and seating the index plunger, the other for clamping the base. The cutter speed is 88 r.p.m., feed 7⅛ in. per min. and the time per piece 0.44 minutes.

A 24-in. machine with one spindle is shown in Fig. 7, milling two motor-chain cases at once. The cases are held on a standard 12x24-in. index base, set at right angles to the table. They are located over studs in drilled holes. The work clamps are operated by cam levers, while the large lever in the center locks the index table. The work is held and the cutters so arranged that opposite ends are milled by the pairs of cutters, giving one complete chain case at each pass of the cutters.

The material is cast-iron, from which 1/16 in. of stock is removed. The cutters are 8 and 6¾ in. in diam. and run at 51 r.p.m. with a feed of 6.4 in. per min. The total time per piece is 0.85 minutes.

Another motor job is shown in Fig. 8, where the piston-pin end of four connecting rods is side-milled and sawed at one pass. The rods are located by finished holes in the small end and positioned by the large, unfinished end. They are clamped in pairs. The indexing is automatic on this job, leaving the operator free to load and unload the fixtures. The cutters run 66 r.p.m. with a feed of 1.76 in. per min. and the time per piece is 0.14 min. This is a standard machine, the complete cycle being rapid advance, mill, rapid return, index and repeat.

Another 24-in. machine, but with a 32-in. table-travel, is shown in Fig. 9, milling the face of cast-iron exhaust manifolds from which ⅛ to 1/16 in. of stock is removed with two 4½-in. end mills running at 66 r.p.m. and with a feed of 8.3 in. per min. The length of the piece requires support at several points and the method of clamping is worthy of careful study. The work rests on two fixed angle supports and on a fixed support

beneath the center arm. It is located by two fixed side stops and one fixed end stop, and is supported by spring plungers at each end.

Both pieces are held in position by two strap-clamps operated by pilot wheels and by one multiple, balanced pilot-wheel clamp. The various spring plungers are all locked by three hand screws. The time per piece is 2.40 minutes.

Milling slot-boss faces on a cast-iron fan bracket is shown in Fig. 10. A standard 24-in. duplex automatic is used to surface both sides of four pieces at once. A standard 12x24-in. index base is used with clamps especially adapted to the work. The four pieces at each end are clamped by a single cam lever actuating the side clamps. The ends are held vertically by the equalizing clamps shown. The machine has double drive and carries four 8-in. milling cutters at 30 r.p.m. with a feed of 3.87 in. per min. The cut caries from $\frac{1}{16}$ to $\frac{1}{8}$ in. and the time per piece is 0.26 minutes.

A wide-bed, 48-in. duplex is at work on a cast-iron crankcase in Fig. 11. It has a special spindle carrier on the right headstock. The pieces are mounted on angle plates held on a special index plate and located by pins in drilled holes. The angle plates are inclined slightly toward the center to facilitate chucking. The cutters shown mill the wings on the ends while the other cutter faces the pad in the center. The special spindle carrier drives from the lower spindle through spur gears. The cut is from $\frac{1}{16}$ to $\frac{1}{8}$ in. at the rate of $3\frac{1}{2}$ in. per min. The cutters are $7\frac{1}{2}$ in. in diam. and run 40 r.p.m. The time per piece is 0.66 minutes.

The Front Axle Job

A very different fixture is necessary to hold the front axle in Fig. 12. This is a special 12x72-in. hand-index base which is capable of holding 83 different sizes and styles of front axles. Two of the supporting and clamping units consist of a four-point balanced support on which the piece rests, bearing on the top of the spring pad (the piece being chucked upside down) and of a heavy clamp operated by a pilot-wheel nut. The piece is located by slipping it over studs in the end holes. These studs are contained in blocks, which are clamped to the top portion of the index base by cam clamps. The studs themselves are removable for various sizes of pin holes, and in addition two extra sets of stud blocks are supplied to take care of variation in distance between the upper and lower pin-hole bosses. As axles of the same nominal center distance between pin holes are subject to variation which may run as high as $\frac{1}{16}$ in., the block carrying the locating pins nearest the operator, is unclamped, while removing and replacing the pieces, by means of a cam clamp.

The operator loads the fixture and mills two sides of the spring pad at one end of the piece. The table is returned rapidly to the starting position to mill the other spring pad. At the completion of this cut, the table returns to the starting position where the pieces are clamped and removed. By this method first one locating-block and then another one is released and reclamped. In order to prevent any tendency for the blocks to eventually creep so far that they are no longer symmetrical about the index center, a graduated scale is fastened to the top plate of the index base and a zero mark is put on each locating block. This enables the operator to check the setting, and also assists in setting up the locating blocks for different lengths of axles.

Due to the length of the axles, the index base had to be made 72 in. long with the result that it overhangs considerably at one end of the table. During the cutting position the top plate of the index base is securely held by two clamps at the forward end and one clamp in the center, the index plunger being located at the forward end. And in order to facilitate indexing, the top plate is held on spring-supported bearings which carry its weight when the clamps are released.

The cutters are 6 in. in diameter, one right- and the other left-hand. These run 53 r.p.m. and remove $\frac{1}{16}$ to $\frac{1}{4}$ in. of metal. On a 1-ton axle the feed is $9\frac{1}{16}$ in. per min. and the time 5.3 min. On a 5-ton axle the feed is $5\frac{9}{16}$ in. and the time 8.9 minutes.

How Not To Sell

By Donald A. Hampson

HOW to sell has become a vital problem for those in the machine trades. When there is little buying, it is axiomatic that the buyer must be catered to. A salesman can make friends or enemies of his firm's customers by his attitude. He can draw out orders that would otherwise be pigeonholed, or he can build up a wall of resistance that it takes years to batter down. It is highly important to production and engineering forces to know why their salesmen are not getting their share of orders.

The idea that a salesman must be a good talker is far from the truth. He must be able to express himself in plain English and to portray the wares he sells, but there the talking value ceases. A flow of words designed merely to sell goods turns away more sales than anything else. One of the hardest facts for salesmen to learn is that a buyer, be he an overalled shop man or an official in the big plant, has nearly always reached that position through training that has qualified him to balance values, to mentally fit a new device into his scheme of production and to see the adaptation to his peculiar needs.

In such cases, the buyer doesn't want to be talked into a device that he cannot use to advantage and nine times out of ten he will not. And the sale that *is* made in that way never boosts a product. It acts as a boomerang, for it is a trait of human nature to broadcast the poor qualities of an article twice to a single mention of the good. To illustrate:

There are some fifteen men "making" a certain city where several prosperous concerns buy a moderate amount of carbon and alloy steels. In the various meetings where the several heads and superintendents of these concerns get the opportunity to trade experiences, one of the agreed points is how much the steel salesmen bore them, what a nuisance they are. Now, everyone knows that the secrets of the steel business are common property and that all reputable makers supply reliable steel. What excuse, then, for a salesman to spend half an hour in "explaining" how and why his steel is better than the other fellow's. It has been disclosed at these chance meetings that just two salesmen are getting all the steel business in that city. It wasn't known among the individual manufacturers, for the lucky salesmen themselves never mentioned it. They dropped in at the plants every two months, sat down with the buyer, talked of business conditions as they had seen them on the road, of the weather, of politics, of the shop's prob-

lems, and perhaps went into the shop to assist on a difficult piece of hardening. Oh yes, before they left, they would ask if anything in the steel line were needed.

Most of the talkers are knockers as well. No competitor is exempt. A salesman demonstrated the merits of his machine, pointing out particularly the places where it was superior to a nationally known competitor. He had a good machine, that was evident, but he also had a line of talk and he was going well on high gear when the buyer stopped him, saying that if he would supply a written guarantee of satisfaction as applied to a certain job, a machine would be bought. The guarantee was given and the machine arrived within a few days. It proved to be equally as good as the machine of another make already in use but valueless as far as the particular guaranteed job was concerned. There was no loss involved in retaining it, for there was work enough for two, but the buyer took occasion to send the worthless guarantee to the factory, along with a highly colored word picture of the kind of "salesman" who got *one* order but failed to make a friend.

Many of the younger salesmen are machinists who have left the bench in search of better pay and improved opportunities on the road. These men should have the shop perspective, and with some business education ought to become the most helpful kind of salesmen. The fact that they do not possess the "gift of gab" is no drawback of itself and need never be apologized for.

Some lines and some fields are overworked. When there are too many men working a territory, it will pay a factory to withdraw and shift sales forces to a less crowded field. A striking example of this exists in a mid-western territory. There are actually 38 men selling plumbing supplies in a section where ten could handle the trade by spending but half their time on the road. The result is either an increased and unjustified addition to the price of the goods or a needless loss to 38 houses or plants. Added to that, every plumber in the region is compelled to spend from one to two hours a week in being courteous to these men. That is not efficiency in selling.

Effect of Poor Clerical Methods

One of the apparently small things which build up sales resistance and throw customers to other houses is the slipshod clerical methods pursued by many concerns in the mechanical field. Failure to answer letters promptly, whether from the inter-department delays of the mammoth concern or the dilatory practice of the one-man office force type, will disgust a buyer quicker than anything else so far discovered. And this is not due to the rush and confusion of super-prosperous days, as is proved by countless instances occurring during the past year or two.

The letters of a manufacturer of small tools top the list in this respect. They have a very good man covering an eastern district and he took away from one shop a nice order for a quantity of a very simple tool. He mailed this order to the New York office on the day it was taken and the latter passed it on to the factory where it went to the engineering department to have the necessary drawings made. The two jumps so far made are each a two-hour train trip. The engineering department discovered a chance to interpret the shop's instructions in two ways and so sent their drawings on for approval or correction. The shop people got the drawings just 23 days from the date when the order was given! And the ironical part was found in the accompanying letter which bore that overworked phrase, "your prompt attention to this will enable us to expedite your order," near the end of the typewritten page.

These people who rubber-stamp or write that "for prompt reply, address attention of J. B. Smith, etc.," are invariably the worst offenders in the matter of delayed letter writing. Production men who wonder why business goes to another house will find, when conditions are analyzed, that price is a minor third cause with poor clerical methods and salesmanship leading most decidedly.

The Matter of Correspondence

Another clerical trick that disgusts mechanical men is that old one of "before and after," i.e., the most polite and prompt attention to correspondence before the sale is made and marked indifference afterward. An extreme case of this kind came to the writer's notice in connection with a machine he bought recently. Every attention was paid to correspondence up to the time the machine was installed and paid for. But along with the machine there were some attachments that it was seen at once would be of no use for the special work at hand and it was thought advisable to return them and get whatever salvage would be allowed. The attachments were standard and, presumably, would sell for about $120 if one had to buy them. Three letters in regard to this matter were mailed (and received, because they were never returned) but no reply was forthcoming. The amount was too small to follow up but it can be said truthfully that this manufacturer will not be considered when another machine is needed.

The dense way in which questions are answered or letters are interpreted also is a source of much annoyance. Once again the point may best be illustrated by an example. A salesman for a specialty machine shop was working over the problems of a particularly live prospect and the work narrowed down to where the sale hinged on the low price for a small part required in quantities. The salesman was a practical man and to save time sent a special delivery letter requesting the price of a stock machine for this work and the quantity of pieces per hour that could be guaranteed.

The salesman camped on the job to clean up other details with the prospect. After a week of waiting and hounding of the post office, he was called elsewhere, to his regret, but he could see that his prospect was "getting cold." Three weeks later there was received an elegantly gotten up proposal to furnish the machine for $——, and depending on acceptance of a score of agreements to do this and that, but no mention of the rate of production. A wire saying, "No. 2 machine $——, production 72 per hour guaranteed," would have cost the concern but a fourth as much as the proposal and would undoubtedly have landed an order for each of the two concerns.

When any manufacturer reaches that stage in efficient organization or has salesmen whose visits customers wait for, he no longer need worry over how not to sell. At conventions and trade exhibitions the writer runs across customers of the house from remote sections of the country and near by, many of whom enquire for Mr. S., naming a salesman now long retired. Then their comments are something like this: "I always liked to buy of him, for he didn't talk too much. He could go right out into the plant and show us where his stuff would save us time. Often I have held an order six months for him to come along."

Job Work Manufacturing Problems

By E. W. Leach and J. T. Koch

Job work as an accessory to production manufacturing—Methods for getting work for the jobbing department—Management factors that determine success

ONE PROBLEM which is common at present among a large majority of metal manufacturing plants is that of getting more business. Factories and machine shops that were favored with government contracts during the war, or those whose business experienced a tremendous growth during war days, immediately expanded in buildings and equipment. This was done in order to catch up and keep up with the apparent increased volume of business and few business men realized that it would not be permanent. Heavy investments were made in fixed assets of various kinds in the belief that the need for their constant use would always be just as pressing.

Then the drop came—and it is still with us. After waiting five or six years to "get back to normal," it has dawned upon us that we probably will never get "back" to normal in the sense of retrogressing to the old order of things and the old scale of prices. We find it is necessary to readjust our programs to fit into a new idea of just what constitutes "normal," the best way to do that being to take conditions as they are and work out the best possible solution of the problem, as it presents itself, using the factors with which we now must deal.

Instead of busy night crews and double shifts, we are now faced with long rows of lathes and drill presses for which there are no jobs. Paid for out of the profitable experiences of war days, they represent a splendid opportunity for still further profits if they can only be kept busy. Regardless of what bankers may tell us about our having "turned the corner," or of the individual instances where plants are crowded with work, the fact remains that at the present time a large number of manufacturing organizations are only operating at a small percentage of their capacity. In most cases the volume of sales of established lines of products has fallen off. In many cases, the demand simply is not there, or, if it is there, it cannot be met without an unusual expenditure in sales promotional work that would be entirely out of proportion to the extra results obtained. In all cases where manufacturers are looking for other articles to make and sell, they are learning that the development and marketing of even a "world beater" is a slow, gradual process, and that distribution of a new and perhaps unfamiliar product cannot be accomplished over night.

The problem, then, becomes one of filling in the gaps with something on which one can get action and get it quickly. Almost instinctively, it seems, one thinks of jobbing work; and thereby hangs a tale.

As many manufacturers have learned to their sorrow, jobbing work and continuous manufacturing are as unlike as East and West. The methods of getting the work into the plant, the precautions necessary in selecting it, the special treatment of its progress through the various departments, the type of cost accounting required—all these things present difficulties and possibilities for heavy losses when one first attempts to break into this field. This article is not written around experience in a jobbing plant, but in a plant which turned to jobbing work as a comparatively temporary measure, looking to it to keep up a profitable volume of business until plans of a more permanent nature might have an opportunity to mature. In this particular case, the experiment is accomplishing exactly the result desired, but there were dark days during the first few months when the General Manager must have wondered whether his organization would ever be able to mold itself to suit the changed conditions.

When a manufacturer decides to go after jobbing work, it is first necessary that he acquaint his trade territory with that fact. There are many simple ways of doing this. If he belongs to the local Civic and Commerce Association, or Manufacturers' Club, or whatever it may be called, he can undoubtedly secure several leads through these sources. Then, too, his personal acquaintance among other business men in the city is usually such that the word is passed around in that way.

AS MANY manufacturers have learned to their sorrow, jobbing work and continuous manufacturing are as unlike as East and West. The methods of getting the work into the plant, the precautions necessary in selecting it, the special treatment of its progress through the various departments, the type of cost accounting required—all these things present difficulties and possibilities for heavy losses when one first attempts to break into this field. This article is not written around experience in a jobbing plant, but in a plant which turned to jobbing work as a comparatively temporary measure, looking to it to keep up a profitable volume of business until plans of a more permanent nature might have an opportunity to mature. In this particular case, the experiment is accomplishing exactly the result desired.

Publications of local circulation can also be used, but it is decidedly questionable whether this type of advertising puts one in touch with the kind of customers who are wanted. For every desirable customer secured through this rather general publicity, such as the classified columns, there will be half a dozen unestablished and would-be manufacturers whose work had best be left alone.

Manufacturers who have been marketing a line of products over a period of years are apt to think about the selling angle of this problem more seriously than one who has been in the jobbing business from the start, and some of them have sent out salesmen to call on possible customers. This is quite a departure from ordinary practice and, as such, it is interesting to observe its results.

The Ideal Job-Work Salesman

Where men have been brought in from the outside to serve as salesmen they have not usually been successful, or at least only temporarily so. The ideal man for this work is one who has been in the organization long enough to be thoroughly familiar with its equipment and methods, and who has held a sufficiently high position so that he can meet business men capably and make an intelligent sales presentation to them. A salesman doing this work will have to talk with factory managers and superintendents, all of them technically trained men or, at least, men with mechanical experience, and unless he is well versed in the production end of things in the plant he represents, he will not be able to hold the confidence of those whom he serves.

A discussion of the best method of compensation would follow the same lines as for any salesman. There are advantages and disadvantages in straight salaries, straight commissions, or combination arrangements. A jobbing work salesman should be willing to be judged entirely by his results. He is out for business and it is the business he personally secures that justifies his cost. It must be remembered, however, that it is profit and not gross sales that determines his usefulness to the firm. In the jobbing field there is always an opportunity to load a plant up with unprofitable work, and it is that very fact which calls for an especially broad-minded and well-grounded man as a salesman.

In a case where a plant's regular volume of business has fallen off but the management does not wish to lose any of the organization, a man who has been an Assistant Superintendent or held some similar position would be an excellent man for the salesman's position. If the "Supe" were willing to buckle in a bit harder and assume some detail which had previously been passed on to his assistant, the latter could probably be spared for this new work and he would have the inside knowledge that would be so essential. The objection may be raised in the minds of some readers that he would have had no experience as an "outside man." Our experience, however, indicates that in such a place, the theoretical phases of the science and art of salesmanship can be subordinated to a thorough knowledge of the plant itself and its production possibilities.

There are certain matters of policy which must be determined before one is ready to get out after business and the first is the fixing of the overhead rates that will be used in figuring on work. Almost invariably it is out of the question to use the same overhead on jobbing work as is used on the regular product of the plant. For the regular product there are sales people and office employees who know nothing about jobbing and who will not devote any of their time to the jobbing end of the busines. The office end of jobbing work usually requires a smaller force than is necessary for an established and continuous product.

Jobbing work customers would not long be content to help share sales and administrative expenses that belong solely to the main product. To include these charges in jobbing rates would usually be imposing a burden on the jobbing part of the business and would materially interfere with successful bidding. Jobbing overhead should be lower, also, because a good part of the overhead is expense which would be going on anyway whether there were jobbing work in the plant or not. In fact, it is to help absorb this unavoidable overhead that the jobbing work is sought.

Let us imagine that our salesman is out on the job and that he has located a concern which needs some special machine work done. The salesman should bring the prospect over to the plant, take him through the factory, show him its facilities for doing the work, introduce him to the men who will guide it through the various processes, and satisfy the prospective customer that he will be best served by turning his work over to this particular plant. The customer should then submit blueprints or actual samples so that an intelligent cost estimate can be made, and so that the men in the factory will have a definite standard to work from. In every case, the customer should be urged to allow initial runs long enough to give production results. Too often people will want half a dozen or so castings machined, and the rate will be fixed in view of a rather vague intention to use a thousand a month "when things get going." Many times these folks never show up again and, while the loss in any one case may be small, it is a thing to be guarded against. Get quantities specified which will enable you to turn out the work efficiently.

Credit Ratings of Customers

If there is one point to be emphasized above all others, it is this: Always know in advance when you are going to get your money, and just where it is coming from. You will be put in touch with three distinct types of people so far as credit is concerned.

First there will be the man who has an idea or an invention, but who is not at the time established in any way. Everyone would be in business for himself if it did not require any capital, and often this type of man is the fellow who would like to figure out some plan whereby the other party would put up the capital and hold the bag. If he wants you to take over the manufacture and sale of his invention on a royalty basis, or some plan of that sort, go slow. We are not taking the attitude that any of these men are intentional "slickers," or that their proposition may not have merit, but business is business and you are trying to establish yourself as a jobbing machinist and not as a financier of new and speculative ventures.

The man who is not rated or established should be entirely willing to make a deposit on his first order with the understanding that the balance is to be paid upon delivery. This deposit should be a substantial one, ranging from 25 to 50 per cent as you may prefer. These terms should continue until your customer has made some sales and demonstrated that he is going to be able to stay in the battle. Then it may be all right

to give him credit until the tenth of the following month, but he should be held rigidly to that period so that his account does not have an opportunity to lag.

The second type of customer is the man who is established, but in some other industry. Here it is well to be a bit more lenient but the manufacturer should make certain whether, through his other connections, he can be held responsible for the work being done for him. The mere fact that a prominent or wealthy man's name appears on the board of directors of some new company is no assurance of financial resources that can be drawn upon to secure payment for services. It should be determined if he can be held wholly responsible, or if he is only making a nominal and round-about investment so that his name may lend prestige to the venture.

It should be remembered, too, that just because a man is successful as a wholesaler is no guarantee that he will be successful as a manufacturer. The fact that a man has grown wealthy in the shoe business or food business is no guarantee that he can do things equally well in the machinery line. What are his chances for success in this particular field? That is the determining factor.

Proper Consideration for the Established Customer

The third type of man is the established business man with a recognized line of credit. It is quite permissible to extend to him the courtesies to which he is entitled. In these days of rapidly changing conditions, however, it is always well to check up the references offered, and to obtain a report from one of the well-known credit agencies. Many firms that have always had a reputation for sound management and healthy growth may be suffering from disorders which make them a poor credit risk. This may sound discouraging and pessimistic, but a single loss can easily wipe out a dozen profits. One must simply look at the situation in the light of actual facts and remember that he is conducting a business and not a charitable institution.

Never permit a man to place an order for quantities of work "to be paid for as used." You do not know what may come up to change his plans in such a way that the work will never be called for. Bill the work out as soon as it is finished. If you are to do foundry work as well as machine work or assembling, be sure that all patterns are mounted for quantity production. If it is necessary to make new patterns or change old ones, see that the pattern work is paid for before proceeding with any further work. When rough castings are put into stock, bill them out as rough castings; then bill for the machine work separately as it is completed. If this practice is not followed religiously, you will constantly find yourself carrying an investment for someone else. Castings may be made one month, machined the next, assembled the third, and you will carry the investment in your foundry payroll for four months before there is a return on it.

If special equipment seems desirable to accomplish certain ends, let it be at the expense of the customer. Jigs and fixtures designed especially for his work should be paid for by him. In some plants where this is not done, the shelves of the tool room are lined with jigs for work which never came up the second time. We do not mean to be too cold-blooded; we do not wish to so surround our suggestions with precautions to be observed and danger lines to be avoided that our readers will be discouraged from going into the jobbing business; but a jobbing manufacturer will often be carried away enthusiastically by the wild dreams of some person who "just needs a couple of thousand more" to put his proposition over. Together they will figure the profits to be shared when every home or every automobile in the country is equipped with this wonderful device. Then, before the shop man really realizes it, the scheme has fallen down and he finds a lot of work performed for which he is unable to collect his pay.

There is good money in the jobbing business and it makes an excellent side line to fill in where an established line has fallen down. It has its compensations which quite offset its troubles. But it is a business all by itself and with peculiar problems which must be met in their own way. The manufacturer who is successful in the jobbing business is the man who can keep his mind on his plant, his eye on his ledger, and his hands on his check book.

Papers Presented at the International Scientific Management Congress, Prague

The first International Scientific Management Congress, held at Prague, Czecho-Slovakia, July 21 to 24, was unsuaul in the character of the papers presented. Many of these dealt with the broader aspects of management as can be seen from the titles which follow.

Among the papers were: "The Importance of Scientific Management for Mankind and for World Peace," by Stan Spacek; Masaryk Academy of Work (M.A.W.), "Its Beginning, Development, Organization and Aim," by Dr. Ing. B. Tolman; "Industrial Research in the United States," by Maurice Holland; "Individual Relations in Industry," by Henry C. Link; "A Recommendation of How to Complete the Working Program of the International Scientific Management Congress in Prague," by Jakub Sousek; "Labor Relationships in American Industry," by Edward S. Cowdrick; "Industrial Relation in Industrial Management," by Dr. Václav Verunác; "The Development of an Industrial Budgetary Control," by Howard Coonley; "Production Control," by G. D. Babcock; and "Belting, Purchase, Maintenance, Power and Methods of Obtaining Complete Data on its Performance," by W. W. Nichols.

The above were followed by papers on "Sales Management," by C. K. Woodbridge; "Management in the Coal Industry," by Sanford E. Thompson; "Some Problems of American Railway Management," by Roy V. Wright; "The Problem of Efficient National Administration," by W. F. Willoughby; "U. S. Department of Commerce and Its Relation to Business," by H. Lawrence Groves; "The Role of Machinery in Agriculture," by H. R. Tolley; and "Scientific Management of Grain and Bread Production," by Prof. Karel Branberger.

There were also further papers on, "Education for the Profession of Engineering," by William E. Wickender; "Training for Engineers," by Dr. Václav Verunác; "The Education of an Engineer for Industry," by J. Prokop; "Vocational Education," by C. R. Dooley; "Advanced and Specialized Education for Commerce and Business Administration in Universities, Colleges and Schools of Engineering," by George W. Coleman; "Scientific Management, Nature, Achievements and Tendencies," by Fred J. Miller; and "Scientific Management," by Dr. Václav Verunác.

Translating Tension Test Results into Terms of Service

CURRENT specifications of the American Society for Testing Materials provide for a tension test as an essential feature in determining the quality of cast steel and malleable iron and as an optional feature in ascertaining the dependability of high test gray iron or semi-steel, and of ordinary gray iron, according to an article in the *Research Group News*. As the specifications of the Testing Society form the basis for many of those commercially used in purchasing materials, it is important to consider the nature of the physical properties demonstrated by the tension test.

The ultimate strength under tension, termed the tensile strength, is that ascertained by pulling apart, at slow, steady speed, a bar of designated dimensions. The machine and grips holding the ends of the test bar must be so designed, that the load is applied axially. This load, as registered by the testing machine at the instant of rupture, is the ultimate strength.

Before the load is applied by the operation of the machine, the area of the throat or that portion of reduced section between the rounded connections for the ends of the specimen, is accurately determined, so that after rupture the ascertained ultimate strength may be calculated and compared, per square inch of section. The resistance to tension, so calculated, is called the tensile strength. The term strength thus used has no significance in relation to toughness. A very brittle material often has a high tensile strength.

From Elastic to Plastic

During the application of the load to the specimen under tension, and generally when about half of the ultimate load is applied, a phenomenon occurs when the structure of the metal changes from an elastic to a plastic condition, in a very noticeable way. At this point the steel specimen suddenly stretches so much under tension that the beam of the testing machines is thrown out of balance, with the result that the floating end of the beam drops to its bottom support. This marks that point at which the material deforms under stress, when increase of strain occurs without increase of stress. It is therefore of great significance in determining the factor of safety used for designing purposes. The phenomenon is called the yield point, but is sometimes erroneously termed the elastic limit.

A careful distinction should always be made in referring to yield point and elastic limit. The yield point is a definite value readily ascertained in routine testing. The true elastic limit is related to the yield point, but represents a value which should be slightly less than the yield point, indicating the maximum resistance to tension without permanent deformation on complete release of the stress. The resistance of the material is thus indicated before structural change occurs. Under certain conditions there is great difficulty in ascertaining the true elastic limit, and a mechanical device has not yet been perfected which is universally regarded as satisfactory for the purpose, notwithstanding much scientific study devoted to the problem. In the case of the cast ferrous metals, the difficulty of applying a device for determining the true elastic limit has been pronounced, causing metallurgists and engineers to resort to the thoroughly practical determination of the yield point, by the use of dividers placed on the test specimen to facilitate observation of the point of accelerated stretch. In most cases, the yield point is determined by noting the load when the beam of the machine suddenly falls. The two indications are necessarily in unison, being caused by the same condition of the specimen. Preference in routine testing is generally given to the observation of the drop of the beam, because in most cases it is more definitely noticed.

Since the engineer who designs a structure or part must proportion it so that it will not deform while under stress, he must pay more attention to yield point than to ultimate strength, in consideration involving safety factors and permissible fiber stresses.

Stretch under Tension

When a load is gradually applied to a piece of metal which has any ductility, the metal of course stretches. The total stretch under tension in the testing machine is called the elongation, and is readily ascertained after the broken bar is removed from the machine, by closely fitting together the ends of the bar at the point of rupture, and comparing the extended length between punch-marks which were scribed to cover a designated length on the specimen before it was pulled. Ferrous materials that are cast have the percentage of elongation determined in a length of 2 in. A percentage of elongation of 25, means that the throat of the bar stretched under tension so that its length was increased from 2 in. to 2½ in. at the instant of rupture.

It will be readily understood from the explanation given, how the percentage of elongation is an important index to ductility. A material which is very brittle and which may or may not be strongly resistant to a considerable load in tension, possesses a low ductility if the percentage of elongation is slight. If one wishes to use material to resist heavy shocks and suddenly applied stresses, the tendency of which will be to strain the material to the deformation point, he should obtain a metal which has a high percentage of elongation as one of the two essential properties by which one may measure ductility.

Since in the case of material which is not inherently brittle, there is a stretch under tension, necessarily there is a reduced cross-section of the stretched member. The extent to which such contracted area should exist, is provided for in specifications covering the manufacture of the toughest and most ductile materials, including cast steel. This gives rise to the requirement covering the percentage of reduction of area occasionally termed the contraction of area.

Having determined before tension testing, the exact diameter of the section of the specimen to be tested, it only remains to ascertain by the use of a micrometer caliper, the reduced diameter at the point of fracture; and then to calculate the area in each case, to obtain the percentage to which the area was reduced during the pull exerted on the specimen, which continually stretched and contracted as the load was increased during the test.

It will be seen that reduction of area is inseparably related to the elongation and that these physical properties considered together are correctly regarded by metallurgists and engineers as a satisfactory measure of ductility. Neither property taken alone, is recognized as a thorough test for ascertaining the degree of ductility of a ferrous metal that should show a high value for this property.

Devices Used in a Southern Pacific Shop

By Howard Campbell
Western Editor, *American Machinist*

Many time-saving tools in the El Paso shops of Southern Pacific—Pulling valve bushings into place—Testing feed valves on the engine—Washing air-pumps

ONE of the greatest assets in any business is a spirit of hearty co-operation. Such a spirit is in evidence in the various shops of the Southern Pacific Railway, and has resulted in the development of many time and labor-saving tools and methods. Some of the tools developed in the El Paso shops are described herewith.

A device for pulling the valve chamber bushing into place is shown in Fig. 1. The bushing is started in, then a 2¾-in. screw is inserted through the valve chamber and bushing and into a bar across the rear end of the chamber, where it is held by a nut. A ratchet lever is applied to the front end of the screw as shown in the illustration and to the lever is coupled a device made from a cylinder taken from the ashpan of a coal-burning locomotive. Suitable inlet and exhaust cocks have been attached and air is supplied from the shop air line. The piston works up and down, operating the ratchet and turning the screw, which pulls the bushing into place. Three men were formerly required to pull a valve bushing into the chamber, operating the ratchet by hand.

In Fig. 2 is shown the use of a cradle by which the traveling crane lifts and holds an air-tank in place while the workmen bolt it to the engine. The use of such a cradle eliminates holding the tank in position by hand while the bolts are being placed. The piece which the man shown in Fig. 3 is holding against the side of the fire-box, is a gage for use in forming throat-sheet patches. The gage is intended for use in the boiler shop, where the flange is formed, and eliminates forming and trying the patch on the erecting floor.

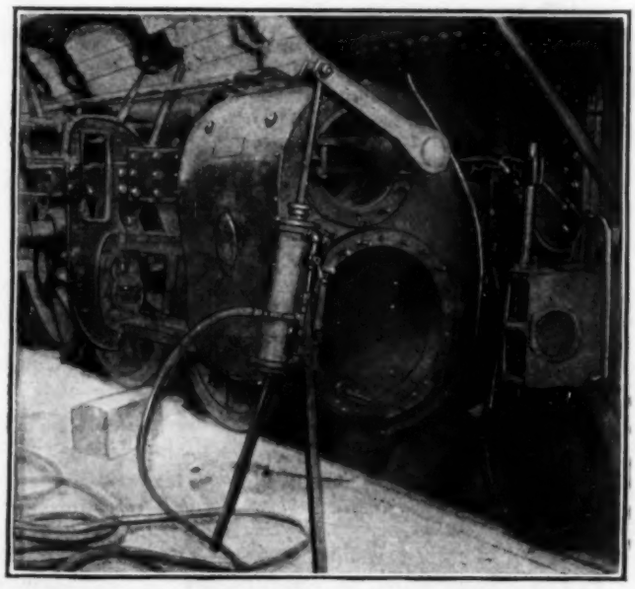


Fig. 1—Pulling a valve bushing into place

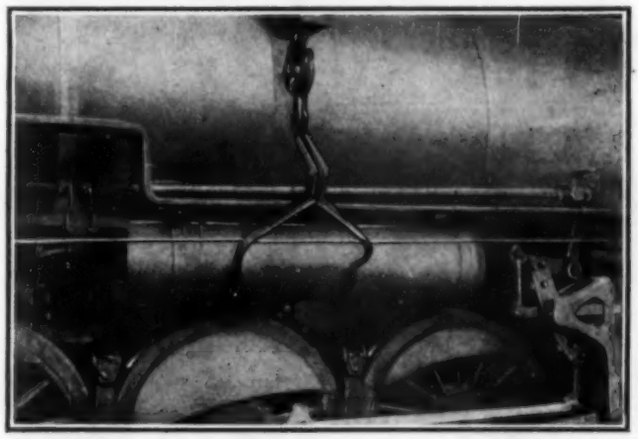


Fig. 2—Cradle for holding air-tank

The truck shown in Fig. 4 is used to hold a pedestal binder in place while it is being attached to the jaws. The beam upon which the operator is sitting serves as a lever, the short end of which is forked as shown. Chains are provided on each of the fork-ends to suspend the binder and it can be easily transported and held in position for assembling, as shown, by one man.

Cylinder heads are ground-in to a seat by the use of the apparatus shown in Fig. 5. A head is placed in position and a supply of abrasive and oil applied to the joint, then the bar *A* is attached to the head. The rod *B* connects the bar to a crank coupled to an air motor, as shown. When the air is applied, the crank is revolved, working the bar *A* up and down and giving the head a part of a turn at each stroke. Pressure is brought to bear against the head during the operation which is continued until a steam-tight joint is obtained.

Variation of an "Old-Man"

An "old man" with a quick-adjusting arm is shown in Fig. 6. Instead of the usual setscrew to hold the arm in position, a hole has been drilled crosswise in the arm at the point *A*, so that it intersects one side of the hole through which the standard passes. The arm is held in position by a large taper pin, flatted on one side, the end of which can be seen in position in the hole at *A*. To adjust the arm it is only necessary to strike a blow on the bottom end of the pin to loosen

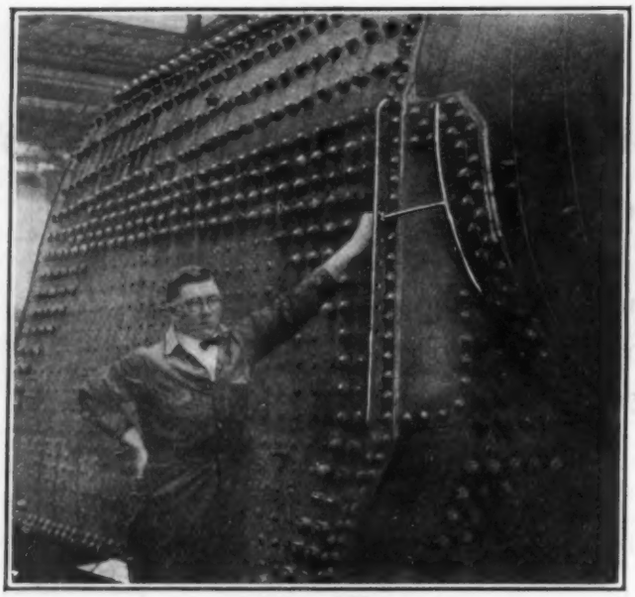


Fig. 3—Throat-sheet patch gage

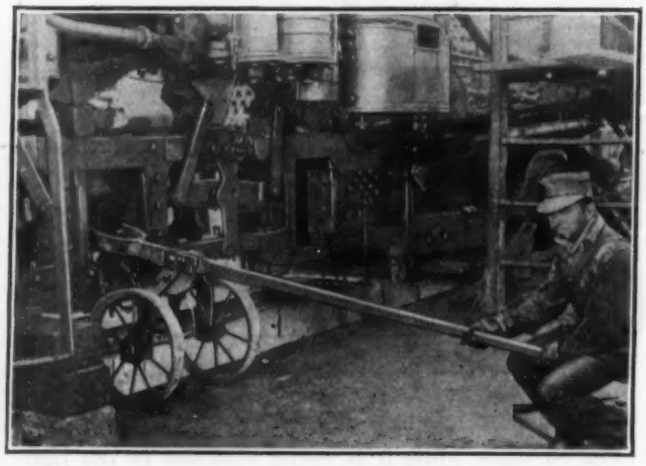


Fig. 4—Pedestal-binder wagon

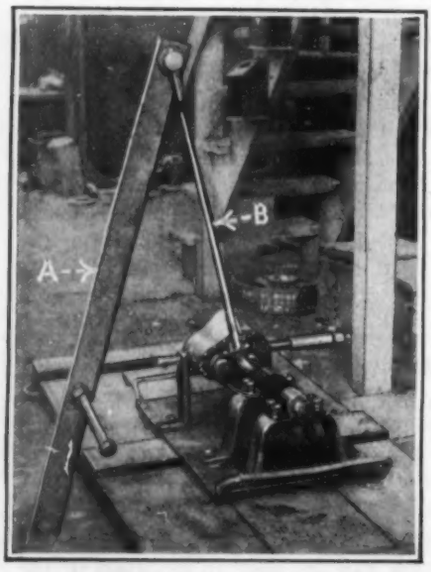


Fig. 5—Apparatus for grinding-in cylinder heads

the arm and another blow on the upper end to lock it in position. A considerable amount of time is saved with this device.

A very efficient and equally simple tool is the rivet-bucking device, made to hold rivets when riveting half flue sheets and shown in Fig. 7. With the use of a wedging bar, which was the previous method, the job required the

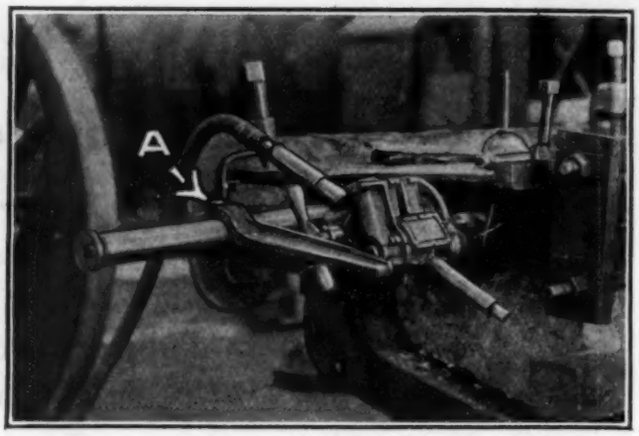


Fig. 6—"Old man" with quick adjustable arm

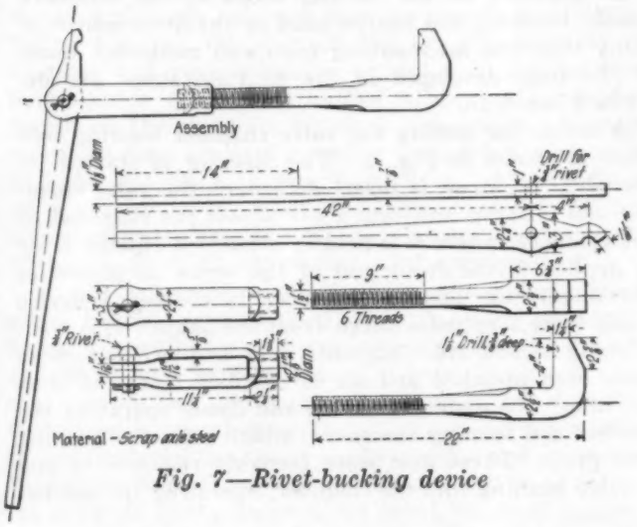


Fig. 7—Rivet-bucking device

services of one boilermaker, two helpers and one rivet heater, and took 5 hr. The tool shown makes it possible to do the job in 1½ hr. with the same number of men. Fig. 8 shows the application of the tool.

The illustration, Fig. 9, shows an apparatus for testing feed and signal valves. A feed valve can be accurately tested with this device without removing it from the engine. The device consists of a standard Ashcroft gage, connected through a cock to a standard signal-hose connection bracket, as shown in Fig. 10. The cock has a $\frac{1}{8}$-in. orifice outlet *C*, as shown. When ready to make a test, the brake pipe leakage is reduced to less than five lb. per minute, then the brake valve is placed in running position and the brake pipe is charged to the pressure carried. Then the testing device is attached to the coupling at the end of the brake pipe and the angle cock is opened. The cut-out cock

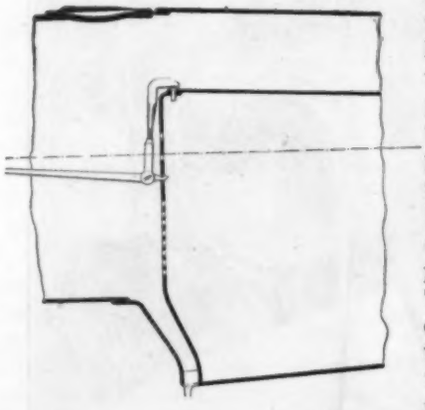


Fig. 8—Application of rivet-bucking device

on the testing device is now opened slowly until the orifice *C* is fully opened, at which point the letter *A* on the stem will point towards the gage. The feed valves should maintain the brake pipe pressure, fluctuating within 2½ lb. of its adjustment. If the brake-pipe pressure drop is more than 2½ lb. and is maintained constantly, it is an indication that the supply valve piston is too loose. If the fluctuation is more than 2½ lb., it indicates a dirty and tight condition of the operating parts of the valve. In order to test the signal whistle, the device is applied in the usual manner and the stem is turned until the letter *B* points toward the gage, at which point the orifice *C* is closed and the signal valve can be tested in the usual manner.

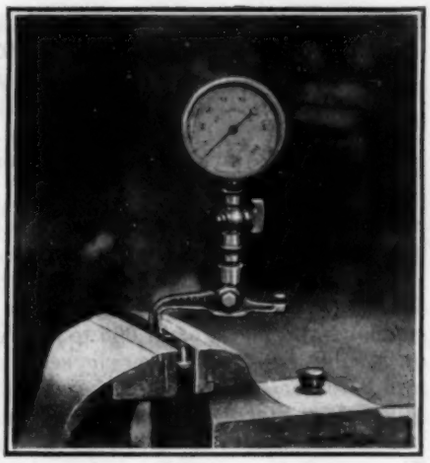


Fig. 9—Apparatus to test feed and signal valves

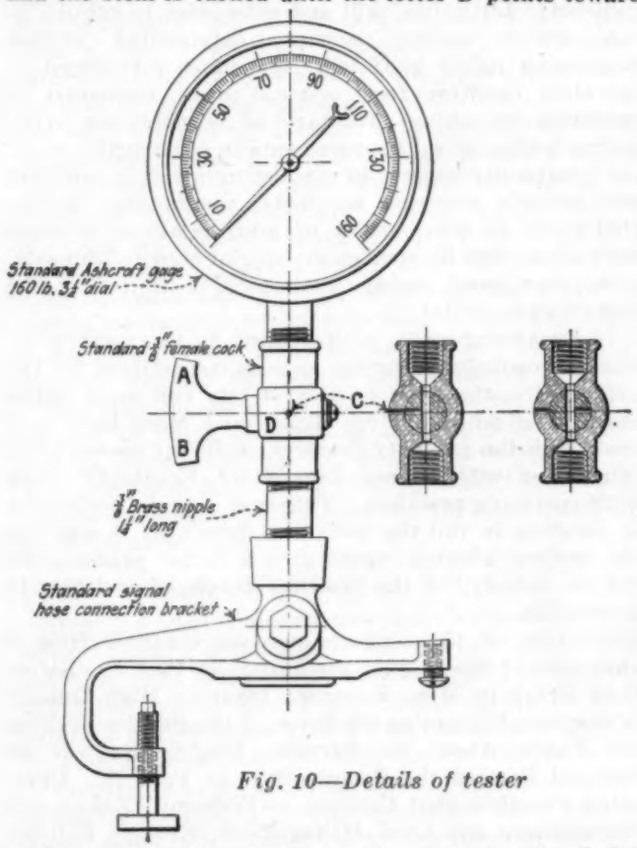


Fig. 10—Details of tester

The device shown in Fig. 11 is used to fill grease cups on side rods. The device is screwed into the top of the grease cup, then the grease is placed in the hole through the side opening and is forced down into the cup by the plunger operated by the lever.

A pump-washing outfit or "portable laundry" is shown in Fig. 12. The outfit consists of a tank on wheels, with connections to the steam supply, the suction or rear end of the air-pump on the locomotive, and the front or discharge end of the pump. The arrangement of the connections is shown in Fig. 13. Approximately 6 gal. of water and 3 lb. of lye are put into the tank and the steam turned on until the water is boiling. An air-hose is connected to the steam channel of the high-pressure air-cylinder, then the air valve is opened so that the pump will work slowly, drawing in

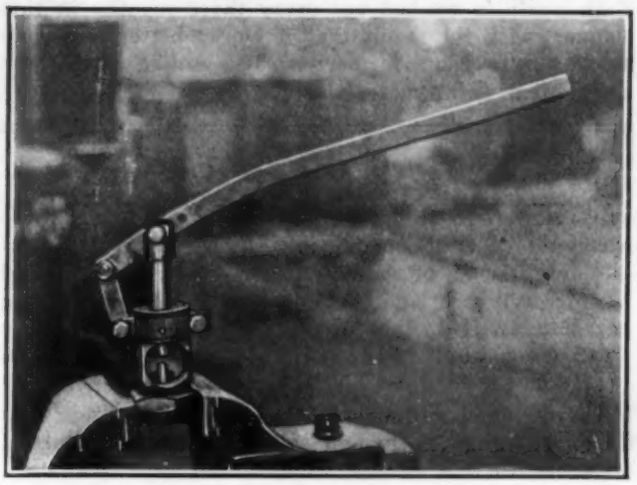


Fig. 11—Device for filling grease cups on side rods

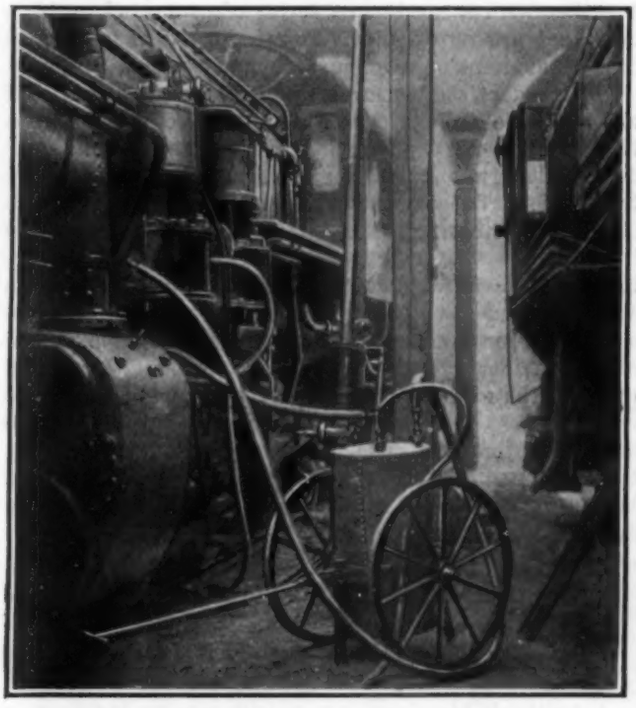


Fig. 12—Portable "laundry" for air pumps

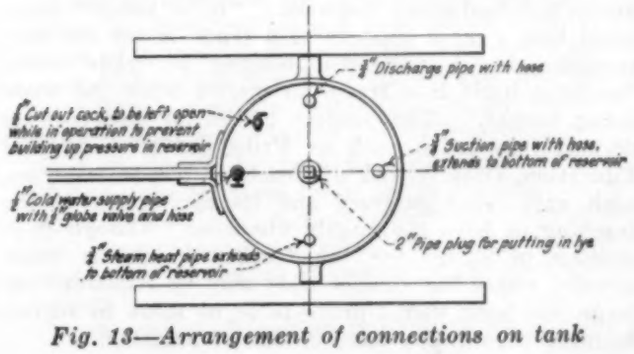

¾" Discharge pipe with hose
¾" Cut out cock, to be left open while in operation to prevent building up pressure in reservoir
¾" Suction pipe with hose, extends to bottom of reservoir
¾" Cold water supply pipe with ¾" globe valve and hose
2" Pipe plug for putting in lye
¾" Steam heat pipe extends to bottom of reservoir

Fig. 13—Arrangement of connections on tank

the lye solution where it circulates and then discharges back into the tank. About an hour of this process will clean the pump thoroughly, after which it is flushed for 10 min. with clean water. The lower end of the hose connected to the rear of the air-pump, is then dropped into a can of dynamo oil so that the oil will be drawn into the pump and will oil it so that it will not rust. Each pump is washed out every three months in this manner, with the result that it works better and lasts much longer than formerly. The entire outfit was made out of scrap materials.

Book Reviews

Elements of Cost Accounting. By Anthony B. Manning, Dean of Faculty, New York Institute of Accountancy and Commerce. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York. Cloth, 5½x8 in., 166 pages, 17 charts. Price $2.

The fundamental principles of cost accounting and its connection with the general accounting procedure is presented in this volume, in a manner that is as complete as it is simple. The material is presented by means of graphic charts with related explanatory text, together with a continuous series of connected problem data that are representative of the practical work in a cost department of a manufacturing concern.

The reader is given a clear idea of the benefits that are available from accurate data as to costs, the relation of the cost department to the planning and production departments and the distribution of costs among the various departments. Every element of cost is considered, starting with the purchase requisition and including the material costs, manufacturing or production costs, manufacturing burden, the handling of sales statistics and sales costs. Both the Job Order system and the Process system are covered, a visible record of the various functions of the system being presented through the graphic charts. Charts showing the forms necessary to the operation of the systems are also given and the author has endeavored, throughout, to present to the student the same kind of conditions that would be encountered in a plant where either of the above systems was in use.

Teaching Shop Work. By Merritt Way Haynes, M.A., Director of Education, United Typothetæ of America. Published by Ginn & Co., 15 Ashburton Place, Boston, Mass. Cloth binding. 233 5x7-in. pages. No illustrations. Price $1.40.

A textbook for those who would become teachers in trade and vocational schools. To quote from the author's introductory remarks: "It is keenly recognized that a mere mastery of a trade is not the only requisite for a successful teacher of trade work. Teaching itself is a trade, no matter what the trade being taught." The subject matter of the book is divided into units, such as Principles of Vocational Education, Observations of Teaching, Trade Analyses, each unit being analyzed and its application to the teaching of boys thoroughly discussed. Though it is written primarily for the teacher in public trade schools, where the student body may be comparatively large, the book should prove to be of value to anyone training boys in any place or line of industry.

Electric Railway Practices in 1923. As revealed in Presentations Made Aug. 15, 1923, to the Charles A. Coffin Foundation by Nearly a Score of Electric Railways. Edited by Henry H. Norris for the Foundation. Published by the American Electric Railway Association, New York, N. Y., 1924. Price $2.

This is a summary and review in book form of the presentations of the electric railway companies made last year in competition for the Charles A. Coffin prize. This award, which takes the form of a medal for the company and a gift of $1,000 to the "employees' benefit" or similar fund of its employees, is to be an annual award to the electric railway company which, during a given year, has made a distinguished contribution to the development of electric railway transportation. The award is one of several made by the Charles A. Coffin Foundation, which was formed in 1922 by the directors of the General Electric Company.

The administration of the contest was in the hands of the American Electric Railway Association, which appointed as a committee C. D. Emmons, Britton I. Budd and James H. McGraw. This committee laid out a plan for the competition embodying eight principal points upon which the award would be made. These included: Initiative, skill and enterprise in popularizing electric railway service; outstanding success in gaining public good will; economies introduced in operation resulting from original ideas; economies in operation by taking advantage of developments originating with others; improvements in construction practice; particular success in conducting a safety program and actually reducing accidents; outstanding accomplishments in development of good relations between the railway and its employees; special accomplishments, aside from good management, tending to reduce the cost of new capital.

In its arrangement in presenting to the readers the material contributed by the various competitors for the Coffin prize, the book is divided into two main parts, the first of which, "More Riders and More Revenue," deals with the publicity features, while the second part, "Operation with Proper Regard for Economy," deals with operating practices. This was done in preference to printing in full the individual briefs, as it was felt the method adopted would give a better presentation for the industry of the practices developed and now in application.

An idea of the contents may be obtained from a statement of the chapter headings: In Part I: Better Cars Bring in More Revenue; Insuring High Quality of Service; Explaining the Scope of the Service; Telling the Public About the Service; Electric Railway an Integral Part of the Community. In Part II: Operating Practices that Conduce to Economy; Economical Maintenance and Good Management; Electric Railway Savings in Construction; the Accident Menace Can Be Controlled; Satisfactory Relations with Employees; Securing Capital for Improvements.

In each chapter are excerpts from the presentations of the various companies that deal with that particular subject. Thus the book forms a handbook on the best practices to be found in the electric railway industry today and should be a good guide for the progressive managers. It is well illustrated, and its 220 pages contain a vast amount of valuable matter to the railway man.

Comments Upon the Principles of Apprenticeship

By A. W. Forbes

In considering the question of apprenticeship it should be recognized that the interests of the employer and of the apprentice are in some respects the same, in others different. The employer is interested in having the apprentice learn to be as skillful as possible and to fill a position as high as possible, at the lowest rate of pay with which he will be satisfied. The apprentice has the same interest in acquiring the greatest possible degree of skill, since it puts him in position better to meet the employer upon any issue in which their interests may conflict.

The "Principles of Apprenticeship," published on page 58 of the *American Machinist*, consider only this joint interest, the training of the apprentice to do as valuable work as possible, without attempting to discuss the fixing of pay or the relation between the apprentice and the other employees. They are based principally upon my own experience in directing the work of boys in a small machine shop in which is handled a variety of work requiring a considerable degree of skill. But I have also considered the experience of others wherever I have been able to secure information about it, as well as what I have been able to learn of the educational methods of the past.

I want particularly to warn against the idea that *all* boys should follow this, or any other, program. There are occupations that have not been considered and there are other types of mind that do not fit into any one program, however broad.

Regarding the age at which a boy should start an apprenticeship, paragraph 3 of the article referred to should be considered to represent a desirable condition; but the fact must be recognized that, for the present, definite age limits are necessary evils. In most cases the best age will be found to be between 12 and 15 years. I know of one boy who had quite plainly passed the age of good apprentice material before he was 15. There may be others who do not sufficiently mature before reaching that age, but I have never observed one.

Age Limits May Be Changed

Any law that prevents one boy from entering his apprenticeship prematurely will prevent others from learning their work at the most desirable age. Therefore the present specific age limits should be recognized as merely crude guides that should be superseded as soon as more desirable ones may be found.

Continuity of progress, paragraph 4, is a factor often neglected in systems of apprenticeship. There is educational value in a decided break of continuity, for which the change from school to work offers a good opportunity, but having started to learn a complex thing like a skilled occupation it should be carried through in continuous progress. One danger in breaking the continuity lies in the fact that it tends to give the impression that education consists of acquiring a quantity of information rather than of gaining a depth of understanding.

Paragraphs 4 and 6 impose narrow limitations upon the number of places suitable for apprentices; thus making it all the more essential that as many apprentices as possible be placed in every satisfactory opening.

Paragraph 6 is based upon the fact that other things are of greater importance than speed in acquiring skill. Among these are the spirit of craftsmanship, team work, initiative, and resourcefulness without aggressiveness. Such qualities are more likely to develop through suitable surroundings than as a result of any amount of instruction. The ideal environment is a room in which skilled work is done under the direction of a man of high character who is thoroughly interested in his work.

Much has been said of the freedom of the college professor in his class instruction. There are even greater reasons for giving the foreman freedom in handling boys. No outside agency can possibly understand the varied factors involved, with their opportunities and dangers. The foreman is primarily interested in his work, and if that is hampered by rules and regulations at the same time that his responsibility is curtailed we cannot expect him to look favorably upon having boys in his department or to give them attention after he gets them.

Paragraph 9 was inserted with this in view. It must be remembered that it is the community that is primarily interested in getting the desirable foremen to take the boys, while but few of the foremen want them. There are comparatively few suitable foremen, and we cannot bring force to bear upon them to make them train the boys, so they must be humored in their minor prejudices.

A Broadening Influence

Work in other departments, paragraph 10, gives breadth, and it is, therefore, desirable; but care must be taken to see that the apprentice does not get the impression that his progress can be measured by the number of things that he knows or can do. He must see that his work in other departments is merely incidental, broadening what he learns in his own, but not in any way a substitute for it. I think the best way to accomplish the result is by sending him to other departments where his help is needed, but not letting him stay there long enough to interfere with his progress in his own department. In my own small shop I have noticed good results by loaning boys to other shops in this way.

The matter of hours, paragraph 11, is more complicated than it is usually considered to be. The short workday is in itself unquestionably desirable for boys, and the temptation is to fix maximum limits by law without giving due consideration to the other factors involved. The eight-hour day is supposed to be a protection to the boys, but the amount of actual protection is problematical.

Cases of overwork are rare, though they sometimes occur; but it is just as easy to overwork a boy in four hours as in twelve. Some athletic instructors say that one-half hour of certain forms of strenuous exercise is all that an athlete in training should have; so if we want to make a law that will really prevent overwork the limit should be, perhaps, twenty minutes—which amounts to the same thing as prohibiting the work entirely. The only practical protection is regular physical examinations, paragraph 12, which will prove whether or not the boy is making proper physical development.

If the object of limiting hours is to provide the boy

with time for recreation and study it can be accomplished better by vacations than by breaking into the working week. The present method of posting laws to the effect that boys must not do this or that until they are of a certain age, and then only for a limited number of hours per day, is questionable. How can we expect a boy who has been brought up in an atmosphere of "Thou shalt not work" ever to become a really first-class workman? Some do—which shows that character is a more powerful force than education. Vacations do not have the injurious effects upon character that result from our present laws.

As to Child Labor Laws

Paragraph 9 conflicts with the child labor laws in nearly all states. If it is desired to keep these regulations for general application, and there are many reasons for doing so, it might be possible to make exceptions as follows: The state inspectors, the same men who are now visiting the employers regularly to see that the laws are enforced, could report any companies, foremen or individuals whom they consider suitable to take apprentices. These reports could be investigated by the educational authorities, state or local, and, if approved, certificates could be issued exempting these employers from the child labor laws. It must be remembered that it is the state that should try to secure employment for the boys, and that the employer cannot be counted upon to take any initiative in the matter.

In paragraph 14 I meant to express the belief that, though a boy should be encouraged to study his work under the direction of his foreman, he should not feel obliged to take up any formal course of such study until he had been engaged in the work for a sufficient length of time to become familiar with it. When we consider the efforts of continuation schools backed by state laws to require such formal courses, and in addition the array of correspondence, Y.M.C.A. and other schools offering such courses, my belief may need a word of explanation.

The argument for such schools rests upon the fact that they help the boy to advance more rapidly in acquiring the technical side of his occupation. My objection to them is based upon the fact that habits of thought are of more importance than is the acquisition of information. The boy has a lifetime in which to acquire a knowledge of facts, and many of the latter will be changed before he makes use of them, but habits must be formed while he is still young.

Intellectual initiative is essential to real progress in any field of high-grade work. We cannot create this initiative in any boy who has not the capacity, but we can provide favorable surroundings for its development; and such surroundings are to be found in desirable jobs. The school courses are favorable to a receptive turn of mind; and by leading the way along a path in which the boy desires to go, they become as effective a check to initiative as could be devised.

Formal courses also tend to carry the boy past the grade of work that he has mastered. A smattering of an advanced subject turns his mind from the things he could master, making him dissatisfied with his actual progress but unwilling to put the time and effort into securing a foundation. This may be the reason why some of us have found that trade and technical school students do better when they undertake some line of work different from what they learned in school.

The objection to formal vocational courses does not apply to the occasional lecture that is inspirational but which frankly makes no attempt to prepare the boy for anything.

General culture study, paragraph 15, is an entirely different proposition. Its object is to make the boy acquainted with other things besides his primary interests; subjects that are of value, but not directly related. Whatever may be the best way to accomplish this purpose the only method available for general application seems to be the formal course.

The question of voluntary or compulsory school training, paragraph 17, has too many sides for an adequate discussion. The present-day tendency is to decrease the liberty, and consequently the responsibility, of the individual, both adult and minor, with the purpose of helping him to avoid mistakes that will be injurious both to himself and to the community.

When we consider the compulsory school from the point of view of the boy, how can we expect him to look upon it as anything but loafing time? He is not doing it for the benefit of anyone but himself, and he does not see the benefit. Even high-grade boys have no feeling that they are doing wrong by bluffing their lessons instead of learning them. To allow a boy to spend the larger part of the time during which his sense of responsibility should be developing in activities that are entirely for his own benefit is questionable moral training, but to require it is worse.

In the case of transfers, paragraph 18, we must recognize the fact that boys cannot tell when they start whether or not they are fitted for an occupation, and they do not seem to make a wise choice much more frequently when they start after graduation from college at the age of twenty-two years than when they start at fourteen. In my own shop, in which the boys work under my personal observation, I have on occasions let a year go by before discovering that a boy was unfitted by nature for the kind of work he was trying to learn. Even then, in some cases, the boy himself did not realize it. Therefore, apprenticeship should place no obstacle in the way of a change when a mistake has been discovered, or when either party thinks there has been a mistake.

Concerning Payment of Apprentices

It is not the purpose of this article to consider methods of determining pay, but merely to point out that the employer should expect to receive at least as large a profit from an apprentice as from other employees. If apprentices are unwilling to work at rates that will allow this they cannot expect opportunities from the average employer.

From the point of view of the boy, if apprenticeship gives him a better education than the free school he should be willing to pay for it, if it is unobtainable otherwise! I do not, however, recommend charging apprentices for their instruction. Those who cannot earn something for their employer above the profit mentioned had best give up the idea of becoming skilled workers. Some apprentices are quite profitable from the start and their pay should be advanced rapidly.

The object of apprenticeship is to enable the boy to fill the highest position of which he is capable in the industry. It should naturally terminate when the goal is reached. Requiring a specified length of time is at best a crude provision. It is results, not years, that are wanted.

American Standard Screw Threads—II

The coarse thread series of screw threads for use with free-fit and medium fit tolerances. Its use is also permissible in some other cases as mentioned

THE American Standard Coarse-Thread Series, defined in Table 6, is recommended for use with Free Fit (Class 2) Tolerances, and Medium Fit Tolerances (Class 3). Its use with Close Fit (Class 4) Tolerances is also permissible, especially in producing the Medium Fit as described on page 10, Sec. 2. It is recommended for use with the Loose Fit Tolerances (Class 1), for nuts only in the numbered sizes.

The resulting dimensions of external and internal screw threads with these fits are shown in Tables 7, 8, 9, 10, 11, 12 and 13.

The first part of this abstract appeared on page 383, Vol. 61, No. 10, and the concluding part will be in Vol. 61, No. 12.

Table 6 Coarse-Thread Series—General Dimensions[1]

1	2	3	4	5	6	7
Identification		Basic Diameters			Thread Data	
Sizes	Threads per Inch (n)	Major Diameter (D) (Inches)	Pitch Diameter (E) (Inches)	Minor Diameter (K) (Inches)	Pitch[2] (p) (Inches)	Basic Depth of Thread (h) (Inches)
1	64	0.0730	0.0629	0.0527	0.0156250	0.01014
2	56	0.0860	0.0744	0.0628	0.0178571	0.01160
3	48	0.0990	0.0855	0.0719	0.0208333	0.01353
4	40	0.1120	0.0958	0.0795	0.0250000	0.01624
5	40	0.1250	0.1088	0.0925	0.0250000	0.01624
6	32	0.1380	0.1177	0.0974	0.0312500	0.02030
8	32	0.1640	0.1437	0.1234	0.0312500	0.02030
10	24	0.1900	0.1629	0.1359	0.0416667	0.02706
12	24	0.2160	0.1889	0.1619	0.0416667	0.02706
1/4	20	0.2500	0.2175	0.1850	0.0500000	0.03248
5/16	18	0.3125	0.2764	0.2403	0.0555556	0.03608
3/8	16	0.3750	0.3344	0.2938	0.0625000	0.04060
7/16	14	0.4375	0.3911	0.3447	0.0714286	0.04640
1/2	13	0.5000	0.4500	0.4001	0.0769231	0.04996
9/16	12	0.5625	0.5084	0.4542	0.0833333	0.05413
5/8	11	0.6250	0.5660	0.5069	0.0909091	0.05905
3/4	10	0.7500	0.6850	0.6201	0.1000000	0.06495
7/8	9	0.8750	0.8028	0.7307	0.1111111	0.07217
1	8	1.0000	0.9188	0.8376	0.1250000	0.08119
1 1/8	7	1.1250	1.0322	0.9394	0.1428571	0.09279
1 1/4	7	1.2500	1.1572	1.0644	0.1428571	0.09279
1 1/2	6	1.5000	1.3917	1.2835	0.1666667	0.10825
1 3/4	5	1.7500	1.6201	1.4902	0.2000000	0.12990
2	4 1/2	2.0000	1.8557	1.7113	0.2222222	0.14434
2 1/4	4 1/2	2.2500	2.1057	1.9613	0.2222222	0.14434
2 1/2	4	2.5000	2.3376	2.1752	0.2500000	0.16238
2 3/4	4	2.7500	2.5876	2.4252	0.2500000	0.16238
3	4	3.0000	2.8376	2.6752	0.2500000	0.16238

[1] The dimensions of screw-thread gages and other important information on the gaging of screw-threads will be found in the second report of this Committee entitled "Gages and Gaging of Screw-threads."

[2] This column is given to seven decimal places for computation purposes only.

Table 7 Coarse-Thread Series—Loose Fit (Class 1)—Nuts[1]

1	2	3	6	7	8	9	10	11
Size	Threads per Inch	Minimum[2] Major Diameter[3] (Inches)	Pitch Diameter			Minor Diameter		
			Minimum[2] (Inches)	Tolerance[4] (Inches)	Maximum (Inches)	Minimum (Inches)	Tolerance (Inches)	Maximum (Inches)
1	64	0.0730	0.0629	0.0026	0.0655	0.0561	0.0017	0.0578
2	56	0.0860	0.0744	0.0028	0.0772	0.0667	0.0019	0.0686
3	48	0.0990	0.0855	0.0031	0.0886	0.0764	0.0023	0.0787
4	40	0.1120	0.0958	0.0034	0.0992	0.0849	0.0027	0.0876
5	40	0.1250	0.1088	0.0034	0.1122	0.0979	0.0027	0.1006
6	32	0.1380	0.1177	0.0038	0.1215	0.1042	0.0034	0.1076
8	32	0.1640	0.1437	0.0038	0.1475	0.1302	0.0034	0.1336
10	24	0.1900	0.1629	0.0046	0.1675	0.1449	0.0045	0.1494
12	24	0.2160	0.1889	0.0046	0.1935	0.1709	0.0045	0.1754

[1] This fit is recommended for nuts only, in the numbered sizes.

[2] Basic diameter.

[3] Dimensions given are allowable only with tap having theoretically sharp corners. Threaded hole must not reject correct basic "Go" gage by interference with rounded roots due to worn tap. Minimum flat at root equals $^1/_{32} \times p$.

[4] The tolerances specified for pitch diameter are cumulative and also include errors of lead and angle.

Table 8 Coarse-Thread Series—Free Fit (Class 2)—Screws

1	2	3	4	4a	5	6	7	8
Size	Threads per Inch	Major Diameter			Pitch Diameter			Maximum[2] Minor Diameter (Inches)
		Maximum[2] (Inches)	Semi-finished and finished bolts and screws Minimum (Inches)	Threaded parts of unfinished hot rolled material Minimum (Inches)	Maximum[2] (Inches)	Tolerance[3] (Inches)	Minimum (Inches)	
1	64	0.0730	0.0692	0.0678	0.0629	0.0019	0.0610	0.0538
2	56	0.0860	0.0820	0.0804	0.0744	0.0020	0.0724	0.0641
3	48	0.0990	0.0946	0.0928	0.0855	0.0022	0.0833	0.0734
4	40	0.1120	0.1072	0.1052	0.0958	0.0024	0.0934	0.0813
5	40	0.1250	0.1202	0.1182	0.1088	0.0024	0.1064	0.0943
6	32	0.1380	0.1326	0.1304	0.1177	0.0027	0.1150	0.0997
8	32	0.1640	0.1586	0.1564	0.1437	0.0027	0.1410	0.1257
10	24	0.1900	0.1834	0.1808	0.1629	0.0033	0.1596	0.1389
12	24	0.2160	0.2094	0.2068	0.1889	0.0033	0.1856	0.1649
1/4	20	0.2500	0.2429	0.2398	0.2175	0.0036	0.2139	0.1887
5/16	18	0.3125	0.3043	0.3011	0.2764	0.0041	0.2723	0.2443
3/8	16	0.3750	0.3660	0.3624	0.3344	0.0045	0.3299	0.2983
7/16	14	0.4375	0.4277	0.4238	0.3911	0.0049	0.3862	0.3499
1/2	13	0.5000	0.4896	0.4852	0.4500	0.0052	0.4448	0.4056
9/16	12	0.5625	0.5513	0.5467	0.5084	0.0056	0.5028	0.4603
5/8	11	0.6250	0.6133	0.6080	0.5660	0.0059	0.5601	0.5135
3/4	10	0.7500	0.7372	0.7316	0.6850	0.0064	0.6786	0.6273
7/8	9	0.8750	0.8610	0.8550	0.8028	0.0070	0.7958	0.7387
1	8	1.0000	0.9848	0.9778	0.9188	0.0076	0.9112	0.8486
1 1/8	7	1.1250	1.1080	1.1002	1.0322	0.0085	1.0237	0.9497
1 1/4	7	1.2500	1.2330	1.2252	1.1572	0.0085	1.1487	1.0747
1 1/2	6	1.5000	1.4798	1.4710	1.3917	0.0101	1.3816	1.2935
1 3/4	5	1.7500	1.7265	1.7162	1.6201	0.0116	1.6085	1.5048
2	4 1/2	2.0000	1.9746	1.9632	1.8557	0.0127	1.8430	1.7274
2 1/4	4 1/2	2.2500	2.2246	2.2132	2.1057	0.0127	2.0930	1.9774
2 1/2	4	2.5000	2.4720	2.4592	2.3376	0.0140	2.3236	2.1933
2 3/4	4	2.7500	2.7220	2.7092	2.5876	0.0140	2.5736	2.4433
3	4	3.0000	2.9720	2.9592	2.8376	0.0140	2.8236	2.6933

[1] Basic diameter.

[2] Dimensions given are figured to intersection of the worn tool are with a centerline through crest and root. Minimum flat at root equals $^1/_8 \times p$.

[3] The tolerances specified for pitch diameter are cumulative and also include errors of lead and angle.

Table 9 Coarse-Thread Series—Free Fit (Class 2)—Nuts

1	2	3	6	7	8	9	10	11
Size	Threads per Inch	Minimum[1,2] Major Diameter (Inches)	Pitch Diameter			Minor Diameter		
			Minimum[1] (Inches)	Tolerance[3] (Inches)	Maximum (Inches)	Minimum (Inches)	Tolerance (Inches)	Maximum (Inches)
1	64	0.0730	0.0629	0.0019	0.0648	0.0561	0.0017	0.0578
2	56	0.0860	0.0744	0.0020	0.0764	0.0667	0.0019	0.0686
3	48	0.0990	0.0855	0.0022	0.0877	0.0764	0.0023	0.0787
4	40	0.1120	0.0958	0.0024	0.0982	0.0849	0.0027	0.0875
5	40	0.1250	0.1088	0.0024	0.1113	0.0979	0.0027	0.1006
6	32	0.1380	0.1177	0.0027	0.1204	0.1042	0.0034	0.1076
8	32	0.1640	0.1437	0.0027	0.1464	0.1302	0.0034	0.1336
10	24	0.1900	0.1629	0.0033	0.1662	0.1449	0.0045	0.1494
12	24	0.2160	0.1889	0.0033	0.1922	0.1709	0.0045	0.1754
1/4	20	0.2500	0.2175	0.0036	0.2211	0.1959	0.0054	0.2013
5/16	18	0.3125	0.2764	0.0041	0.2805	0.2524	0.0060	0.2584
3/8	16	0.3750	0.3344	0.0045	0.3389	0.3073	0.0068	0.3141
7/16	14	0.4375	0.3911	0.0049	0.3960	0.3602	0.0077	0.3679
1/2	13	0.5000	0.4500	0.0052	0.4552	0.4167	0.0084	0.4251
9/16	12	0.5625	0.5084	0.0056	0.5140	0.4733	0.0080	0.4813
5/8	11	0.6250	0.5660	0.0059	0.5719	0.5266	0.0098	0.5364
3/4	10	0.7500	0.6850	0.0064	0.6914	0.6417	0.0109	0.6526
7/8	9	0.8750	0.8028	0.0070	0.8098	0.7547	0.0120	0.7667
1	8	1.0000	0.9188	0.0076	0.9264	0.8647	0.0135	0.8782
1 1/8	7	1.1250	1.0322	0.0085	1.0407	0.9704	0.0154	0.9858
1 1/4	7	1.2500	1.1572	0.0085	1.1657	1.0954	0.0154	1.1108
1 1/2	6	1.5000	1.3917	0.0101	1.4018	1.3196	0.0180	1.3376
1 3/4	5	1.7500	1.6201	0.0116	1.6317	1.5335	0.0216	1.5551
2	4 1/2	2.0000	1.8557	0.0127	1.8684	1.7594	0.0241	1.7835
2 1/4	4 1/2	2.2500	2.1057	0.0127	2.1184	2.0094	0.0241	2.0335
2 1/2	4	2.5000	2.3376	0.0140	2.3516	2.2294	0.0270	2.2564
2 3/4	4	2.7500	2.5876	0.0140	2.6016	2.4794	0.0270	2.5064
3	4	3.0000	2.8376	0.0140	2.8516	2.7294	0.0270	2.7564

[1] Basic diameter.

[2] Dimensions given are allowable only with tap having theoretically sharp corners. Threaded hole must not reject correct basic "Go" gage by interference with rounded roots due to worn tap. Minimum flat at root equals $^1/_{32} \times p$.

[3] The tolerances specified for pitch diameter are cumulative and also include errors of lead and angle.

Table 10 Coarse-Thread Series—Medium Fit (Class 3)—Screws

1	2	3	4	5	6	7	8	9
Size	Threads per Inch	Major Diameter			Pitch Diameter			Maximum[2] Minor Diameter (Inches)
		Maximum[1] (Inches)	Tolerance (Inches)	Minimum (Inches)	Maximum[1] (Inches)	Tolerance[3] (Inches)	Minimum (Inches)	
1	64	0.0730	0.0038	0.0692	0.0629	0.0014	0.0615	0.0538
2	56	0.0860	0.0040	0.0820	0.0744	0.0015	0.0729	0.0641
3	48	0.0990	0.0044	0.0946	0.0855	0.0016	0.0839	0.0734
4	40	0.1120	0.0048	0.1072	0.0958	0.0017	0.0941	0.0813
5	40	0.1250	0.0048	0.1202	0.1088	0.0017	0.1071	0.0943
6	32	0.1380	0.0054	0.1326	0.1177	0.0019	0.1158	0.0997
8	32	0.1640	0.0054	0.1586	0.1437	0.0019	0.1418	0.1257
10	24	0.1900	0.0056	0.1834	0.1629	0.0024	0.1605	0.1389
12	24	0.2160	0.0066	0.2094	0.1889	0.0024	0.1865	0.1649
1/4	20	0.2500	0.0072	0.2428	0.2175	0.0026	0.2149	0.1887
5/16	18	0.3125	0.0082	0.3043	0.2764	0.0030	0.2734	0.2443
3/8	16	0.3750	0.0090	0.3660	0.3344	0.0032	0.3312	0.2963
7/16	14	0.4375	0.0098	0.4277	0.3911	0.0036	0.3875	0.3499
1/2	13	0.5000	0.0104	0.4896	0.4500	0.0037	0.4463	0.4056
9/16	12	0.5625	0.0112	0.5513	0.5084	0.0040	0.5044	0.4603
5/8	11	0.6250	0.0118	0.6132	0.5660	0.0042	0.5618	0.5135
3/4	10	0.7500	0.0136	0.7372	0.6850	0.0045	0.6805	0.6273
7/8	9	0.8750	0.0140	0.8610	0.8028	0.0049	0.7979	0.7387
1	8	1.0000	0.0152	0.9848	0.9188	0.0054	0.9134	0.8466
1 1/8	7	1.1250	0.0170	1.1080	1.0322	0.0059	1.0263	0.9497
1 1/4	7	1.2500	0.0170	1.2330	1.1572	0.0059	1.1513	1.0747
1 3/8	6	1.3000	0.0202	1.4798	1.3917	0.0071	1.3846	1.2955
1 3/4	5	1.7500	0.0232	1.7368	1.6201	0.0082	1.6119	1.5046
2	4 1/2	2.0000	0.0254	1.9746	1.8557	0.0089	1.8468	1.7274
2 1/4	4 1/2	2.2500	0.0254	2.2246	2.1057	0.0089	2.0968	1.9774
2 1/2	4	2.5000	0.0280	2.4720	2.3376	0.0097	2.3279	2.1933
2 3/4	4	2.7500	0.0280	2.7220	2.5876	0.0097	2.5779	2.4433
3	4	3.0000	0.0280	2.9720	2.8376	0.0097	2.8279	2.6933

[1] Basic diameter.
[2] Dimensions given are figured to the intersection of the worn tool arc with a center line through crest and root. Minimum flat at root equals 1/8 × p.
[3] The tolerances specified for pitch diameter are cumulative and also include errors of lead and angle.

Table 11 Coarse-Thread Series—Medium Fit (Class 3)—Nuts

1	2	3	6	7	8	9	10	11
Size	Threads per Inch	Minimum[1] Major Diameter[2] (Inches)	Pitch Diameter			Minor Diameter		
			Minimum[1] (Inches)	Tolerance[3] (Inches)	Maximum (Inches)	Minimum (Inches)	Tolerance (Inches)	Maximum (Inches)
1	64	0.0730	0.0629	0.0014	0.0643	0.0561	0.0017	0.0578
2	56	0.0860	0.0744	0.0015	0.0759	0.0667	0.0019	0.0686
3	48	0.0990	0.0855	0.0016	0.0871	0.0764	0.0023	0.0787
4	40	0.1120	0.0958	0.0017	0.0975	0.0849	0.0027	0.0876
5	40	0.1250	0.1088	0.0017	0.1105	0.0979	0.0027	0.1006
6	32	0.1380	0.1177	0.0019	0.1196	0.1042	0.0034	0.1076
8	32	0.1640	0.1437	0.0019	0.1456	0.1302	0.0034	0.1336
10	24	0.1900	0.1629	0.0024	0.1653	0.1449	0.0045	0.1494
12	24	0.2160	0.1889	0.0024	0.1913	0.1709	0.0045	0.1754
1/4	20	0.2500	0.2175	0.0026	0.2201	0.1959	0.0054	0.2013
5/16	18	0.3125	0.2764	0.0030	0.2794	0.2524	0.0060	0.2584
3/8	16	0.3750	0.3344	0.0032	0.3376	0.3073	0.0068	0.3141
7/16	14	0.4375	0.3911	0.0036	0.3947	0.3602	0.0077	0.3679
1/2	13	0.5000	0.4500	0.0037	0.4537	0.4167	0.0084	0.4251
9/16	12	0.5625	0.5084	0.0040	0.5124	0.4723	0.0090	0.4813
5/8	11	0.6250	0.5660	0.0042	0.5702	0.5266	0.0098	0.5364
3/4	10	0.7500	0.6850	0.0045	0.6895	0.6417	0.0109	0.6526
7/8	9	0.8750	0.8028	0.0049	0.8077	0.7547	0.0120	0.7667
1	8	1.0000	0.9188	0.0054	0.9242	0.8647	0.0135	0.8782
1 1/8	7	1.1250	1.0322	0.0059	1.0381	0.9704	0.0154	0.9858
1 1/4	7	1.2500	1.1572	0.0059	1.1631	1.0954	0.0154	1.1108
1 3/8	6	1.5000	1.3917	0.0071	1.3988	1.3196	0.0180	1.3376
1 3/4	5	1.7500	1.6201	0.0082	1.6283	1.5335	0.0216	1.5551
2	4 1/2	2.0000	1.8557	0.0089	1.8646	1.7594	0.0241	1.7835
2 1/4	4 1/2	2.2500	2.1057	0.0089	2.1146	2.0094	0.0241	2.0335
2 1/2	4	2.5000	2.3376	0.0097	2.3473	2.2294	0.0270	2.2564
2 3/4	4	2.7500	2.5876	0.0097	2.5973	2.4794	0.0270	2.5064
3	4	3.0000	2.8376	0.0097	2.8473	2.7294	0.0270	2.7564

[1] Basic diameter.
[2] Dimensions given are allowable only with tap having theoretically sharp corners. Threaded hole must not reject correct basic "Go" gage by interference with rounded roots due to worn tap. Minimum flat at root equals 1/16 × p.
[3] The tolerances specified for pitch diameter are cumulative and also include errors of lead and angle.

Table 12 Coarse-Thread Series—Close Fit (Class 4)—Screws

1	2	3	4	5	6	7	8	9
Size	Threads per Inch	Major Diameter			Pitch Diameter			Maximum[2] Minor Diameter (Inches)
		Maximum[1] (Inches)	Tolerance (Inches)	Minimum (Inches)	Maximum (Inches)	Tolerance[3] (Inches)	Minimum (Inches)	
1	64	0.0730	0.0038	0.0692	0.0630	0.0007	0.0623	0.0538
2	56	0.0860	0.0040	0.0820	0.0746	0.0007	0.0739	0.0641
3	48	0.0990	0.0044	0.0946	0.0857	0.0008	0.0849	0.0734
4	40	0.1120	0.0048	0.1072	0.0960	0.0009	0.0951	0.0813
5	40	0.1250	0.0048	0.1202	0.1090	0.0009	0.1081	0.0943
6	32	0.1380	0.0054	0.1326	0.1179	0.0010	0.1169	0.0997
8	32	0.1640	0.0054	0.1586	0.1439	0.0010	0.1429	0.1257
10	24	0.1900	0.0066	0.1834	0.1632	0.0012	0.1620	0.1389
12	24	0.2160	0.0068	0.2094	0.1892	0.0012	0.1880	0.1649
1/4	20	0.2500	0.0072	0.2428	0.2178	0.0013	0.2165	0.1887
5/16	18	0.3125	0.0082	0.3043	0.2767	0.0015	0.2752	0.2443
3/8	16	0.3750	0.0090	0.3660	0.3348	0.0016	0.3332	0.2963
7/16	14	0.4375	0.0098	0.4277	0.3915	0.0018	0.3897	0.3499
1/2	13	0.5000	0.0104	0.4896	0.4504	0.0019	0.4485	0.4056
9/16	12	0.5625	0.0112	0.5513	0.5089	0.0020	0.5069	0.4603
5/8	11	0.6250	0.0118	0.6132	0.5665	0.0021	0.5644	0.5135
3/4	10	0.7500	0.0128	0.7372	0.6836	0.0023	0.6833	0.6273
7/8	9	0.8750	0.0140	0.8610	0.8034	0.0024	0.8010	0.7387
1	8	1.0000	0.0152	0.9848	0.9195	0.0027	0.9168	0.8466
1 1/8	7	1.1250	0.0170	1.1080	1.0330	0.0030	1.0300	0.9497
1 1/4	7	1.2500	0.0170	1.2330	1.1580	0.0030	1.1550	1.0747
1 3/8	6	1.5000	0.0202	1.4798	1.3926	0.0036	1.3890	1.2955
1 3/4	5	1.7500	0.0232	1.7268	1.6211	0.0041	1.6170	1.5046
2	4 1/2	2.0000	0.0254	1.9746	1.8568	0.0044	1.8524	1.7274
2 1/4	4 1/2	2.2500	0.0254	2.2246	2.1068	0.0044	2.1024	1.9774
2 1/2	4	2.5000	0.0280	2.4720	2.3389	0.0048	2.3341	2.1933
2 3/4	4	2.7500	0.0280	2.7220	2.5889	0.0048	2.5841	2.4433
3	4	3.0000	0.0280	2.9720	2.8389	0.0048	2.8341	2.6933

[1] Basic diameter.
[2] Dimensions given are figured to the intersection of the worn tool arc with a centerline through crest and root. Minimum flat at root equals 1/8 × p.
[3] The tolerances specified for pitch diameter are cumulative and also include errors of lead and angle.

Table 13 Coarse-Thread Series—Close Fit (Class 4)—Nuts

1	2	3	6	7	8	9	10	11
Size	Threads per Inch	Minimum[1] Major Diameter[2] (Inches)	Pitch Diameter			Minor Diameter		
			Minimum[1] (Inches)	Tolerance[3] (Inches)	Maximum (Inches)	Minimum (Inches)	Tolerance (Inches)	Maximum (Inches)
1/4	20	0.2500	0.2175	0.0013	0.2188	0.1959	0.0054	0.2013
5/16	18	0.3125	0.2764	0.0015	0.2779	0.2524	0.0060	0.2584
3/8	16	0.3750	0.3344	0.0016	0.3360	0.3073	0.0068	0.3141
7/16	14	0.4375	0.3911	0.0018	0.3929	0.3602	0.0077	0.3679
1/2	13	0.5000	0.4500	0.0019	0.4519	0.4167	0.0084	0.4251
9/16	12	0.5625	0.5084	0.0020	0.5104	0.4723	0.0090	0.4813
5/8	11	0.6250	0.5660	0.0021	0.5681	0.5266	0.0098	0.5364
3/4	10	0.7500	0.6850	0.0023	0.6873	0.6417	0.0109	0.6526
7/8	9	0.8750	0.8028	0.0024	0.8052	0.7547	0.0120	0.7667
1	8	1.0000	0.9188	0.0027	0.9215	0.8647	0.0135	0.8782
1 1/8	7	1.1250	1.0322	0.0030	1.0352	0.9704	0.0154	0.9858
1 1/4	7	1.2500	1.1572	0.0030	1.1602	1.0954	0.0154	1.1108
1 3/8	6	1.5000	1.3917	0.0036	1.3953	1.3196	0.0180	1.3376
1 3/4	5	1.7500	1.6201	0.0041	1.6242	1.5335	0.0216	1.5551
2	4 1/2	2.0000	1.8557	0.0044	1.8601	1.7594	0.0241	1.7835
2 1/4	4 1/2	2.2500	2.1057	0.0044	2.1101	2.0094	0.0241	2.0335
2 1/2	4	2.5000	2.3376	0.0048	2.3424	2.2294	0.0270	2.2564
2 3/4	4	2.7500	2.5876	0.0048	2.5924	2.4794	0.0270	2.5064
3	4	3.0000	2.8376	0.0048	2.8424	2.7294	0.0270	2.7564

[1] Basic diameter.
[2] Dimensions given are allowable only with tap having theoretically sharp corners. Threaded hole must not reject correct basic "Go" gage by interference with rounded roots due to worn tap. Minimum flat at root equals 1/16 × p.
[3] The tolerances specified for pitch diameter are cumulative and also include errors of lead and angle.

The concluding part of the abstract of the screw thread report will deal with the fine-thread series recommended for use with medium fit and close fit tolerances and permissible with free fit tolerances.

Biennial Census of the Production of Saws in 1923

The Department of Commerce announces that, according to reports for the biennial census of manufactures, 1923, the establishments engaged primarily in the manufacture of saws in that year reported such products valued at $28,812,537, together with other classes of products valued at $1,829,321, making a total of $30,641,858. The rate of increase in the total value of products as compared with 1921, the last preceding year when a census was taken by the government, was 68.5 per cent.

In addition, saws were manufactured to some extent as secondary products by establishments engaged primarily in other industries. The value of the saws thus made outside the industry proper in 1921 was $853,333, an amount equal to 4.7 per cent of the total value of products reported for the industry as classified. The corresponding value for 1923 has not yet been ascertained, but will be shown in the final report of the present census.

Automotive Production

Training Men for Automobile Work

By John Younger
Associate Editor, *American Machinist*

How Buick trains repair mechanics to work on a flat-rate schedule system—Men taught to adapt piece-rate methods to repair shop jobs

THE Buick Motor Co., Flint, Mich., is one of the oldest automobile manufacturing companies in the country, yet it has always contrived to keep up-to-date in the various rapid developments of the industry. Possibly this article, which deals with a fundamental study of an old problem, will prove helpful not only to the automobile industry but to other industries that are faced with similar problems.

Manufacturing intelligence has long been concentrated on engineering and production. Maintenance was a regrettable necessity, postponed as long as possible, and then given attention grudgingly. Times have changed, at least in the automobile industry, and the study of car maintenance is now occupying the attention of chief executives everywhere. Costs of repair work previously varied so much that a job for which a car owner would pay a dollar in Detroit, might cost him several dollars in Texas, in Cleveland, or in Buffalo. Or the situation might possibly be reversed and the job at the factory cost more than in the small town.

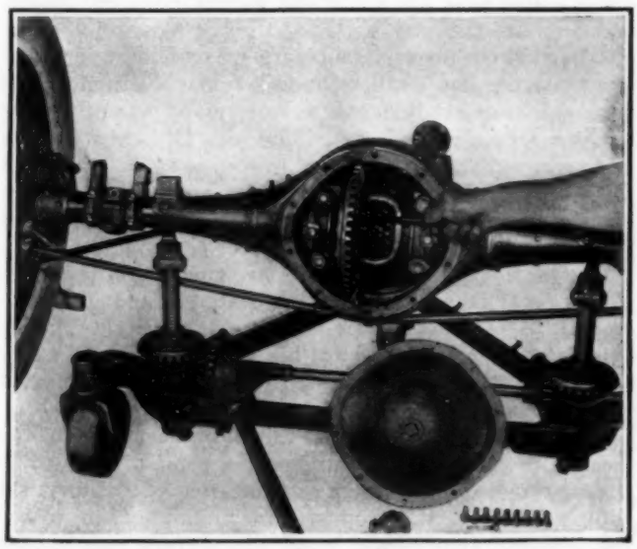


Fig. 1—Remove cotter pins from axle-shaft nuts

With the increase of touring, these differences were noted and commented on adversely, so that a move to standardize costs of repair to the owner gathered momentum among the wide-awake manufacturers. Various schemes have been tried and adopted or discarded. The Buick management has, however, recognized the fact that the first step in the chain is to

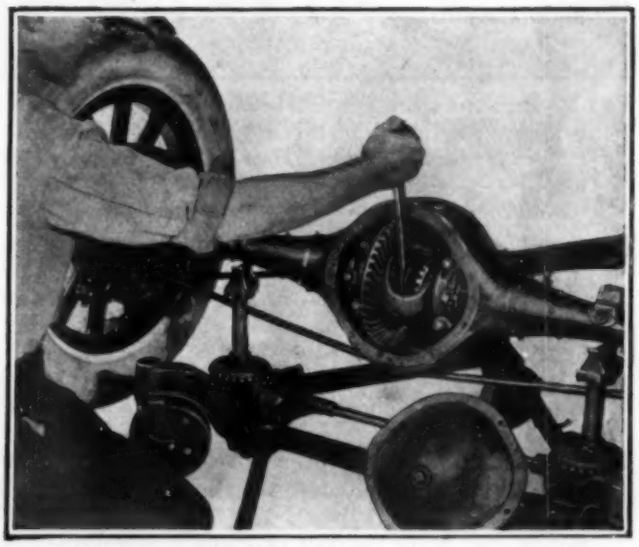


Fig. 2—Remove axle-shaft nuts, No. 65,111

standardize the repair-shop mechanics, and this it is doing in a unique way.

The Flint School of Technology is perhaps the real starting point of the standardization of repair-shop mechanics. Major Sobey, head of this school, realized that if he were going to teach practical repair-shop mechanics on 200 different makes of cars, it would tax all his resources, including finances, equipment and space. He decided to concentrate on one make and naturally the choice fell on the long-established Buick. It is hoped, however, to extend the system to the other cars built in Flint in due time, as conditions warrant.

AUTOMOTIVE PRODUCTION

With the co-operation of the Buick Co., about 15 men are put through an intensive course in the repair and maintenance of Buick cars each month. About 60 per cent of their work is thoroughly practical, extending to instruction in the use of tools, both hand and machine. The Buick Co. lends the school the necessary cars, units, tools and fixtures used in repair work and the school charges the individual student $125 for the course, to cover the net cost of instruction. There is no profit made, which shows a broad viewpoint. Men are taken from any city or state in the Union and they are under no obligations to stay in Flint or to join the Buick

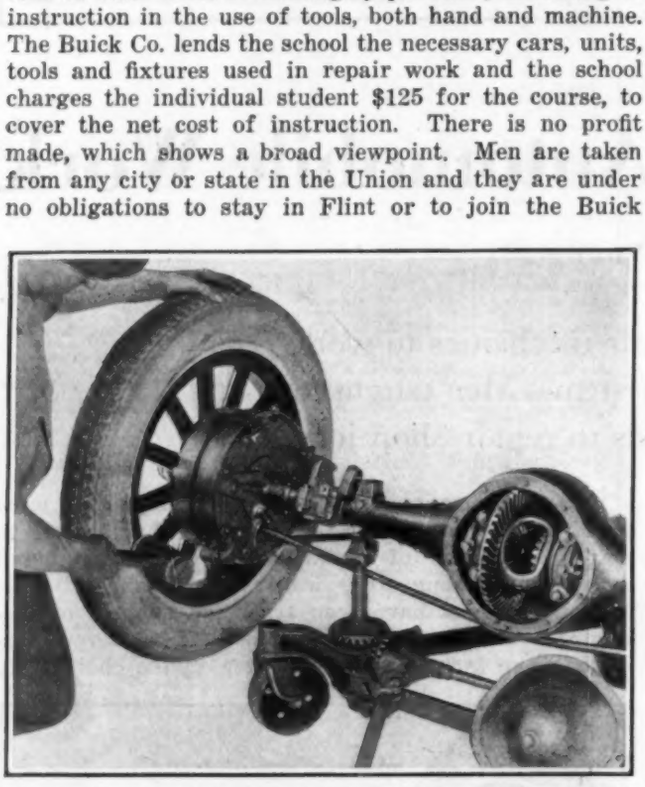


Fig. 3—Pull out wheels and axle shafts until inner ends of shafts are clear of the differential assembly. If necessary, strike wheel with a soft-faced hammer

forces. There is a demand in the Buick organization, however, for more men than can be supplied, so that naturally many gravitate into that company's field-staff and the city is indirectly benefited.

The course is twelve weeks. Forty-four actual hours per week are spent in the school, and three or more hours per night at home study. The average age of the students is about 25 years and they are usually keen, ambitious men who have been out in the world a bit and have learned to appreciate the necessity for getting more training.

Lessons are given in the morning. Questions are asked and problems given. A typical problem is "Draw a sectional sketch of a cup-and-cone bearing and mention one place where it is used in a Buick car." One of the questions is, "What is the principal secret in straightening sheet metal?" In the afternoon the practical side is taken up and the students work either on the Buick cars belonging to the school or in the machine shop, learning the mysteries of cylinder regrinding or honing, or in actually machining parts. The cars are of the very latest models used by the service organization. Executives of the Buick plant talk to the students three times a week. The men get concentrated instruction on one make of car and are well qualified when they pass their tests at the end of the twelve weeks. The late Frank Gilbreth would probably have agreed that they were being instructed as far as possible in the "One Best Way."

While the foregoing treats of the training of new men, it is to be remembered that the Buick organization already has about 4,000 service stations, and that it is necessary to have some means of keeping in touch with the men who are actually engaged in repair work in the field. This contact is secured by holding "service clinics" in different territories, at which groups of about fifty men attend. In the case of Philadelphia, for example, four clinics will be held on successive days, lasting ten hours each day. Two-hundred repair mechanics will be reached in these talks.

The lastest mechanical information is given and any new tools and fixtures that have been developed by the service organization are shown and discussed. Some of the Buick factory executives attend these clinics and are constantly moving from territory to territory maintaining as far as possible, intimate contact with the men in the various territories.

Use of Illustrated Bulletins

In addition, bulletins are issued, their salient features being that they are short, very much to the point and cover only one subject. These bulletins fill in the gaps between the clinics. Figs. 1, 2 and 3 are taken from a single page of a recent bulletin and show the 5th, 6th and 7th operations in complete disassembly. All necessary information is given in the captions. It should also be stated that some of the large distributors of Buick cars hold schools of their own, in which mechanical subjects pertaining to repair work are studied and worked out in a practical manner.

When considering pricing the work, it would seem that the logical procedure would be for the service department of the factory to conduct time studies on the operations and from these studies evolve the best time and the possible price. Both A. H. Sarvis, the head of the department, and his assistant, M. S. Young, agreed that this might be good in theory but that in practice it would not work out. Cars to be repaired are dirty, cotter pins are rusty and do not come out easily, and nuts are frequently rusted tight. A new job right off the factory floor is therefore no criterion for time study. Since one swallow doesn't make a summer, nor does one time-study make a rate, many examples are noted before a price is set. The jobs all being done in the approved way, the law of averages holds good, and the average of any ten cases will probably be about right. However, the times are constantly being checked from reports that come from all over the country.

One of the features of this development is, that Mr. Young established a price to the customer and standardized it. It is the service-man's job to operate inside this price in order to secure his profit, for which needless to say, a margin is allowed. This set of established prices is called the "Flat Rate Schedule."

The next logical step is a wage incentive to the mechanic. Having standardized the price of the job to the customer, a percentage of this price is obviously set aside for labor. It is comparatively simple then, to tell the mechanic that he will be allowed a given sum for the job and that it is up to him to see how fast he can do it.

AUTOMOTIVE PRODUCTION

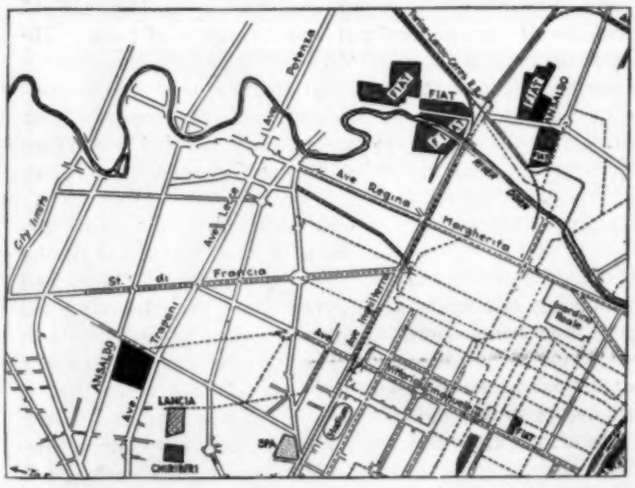
Under this system it has been found that mechanics have been speeded up on an average of 30 per cent.

It may be thought that there would be too big a variety of jobs to be standardized in this way, but this has not been the case. Experience has shown the Buick Co. that there are only about 40 major operations that repeat themselves, but that in order to cover the whole field they have detailed over 500 operations. This may not be agreed to by all but it pre-supposes a reasonable intelligence in the minds of the mechanics, so that they can reason from one job to a simliar one. Some of the dealers are adopting the flat price system to wash-rack operations and Mr. Sarvis believes that it is only a question of a short time until all Buick dealers will be on a 100 per cent flat-rate basis. From the point of view of the men, the plan is working well and there has been nothing but satisfaction expressed concerning it. Similar sentiments come from the human factor, the customer.

Societa Anonima Automobili Ansaldo

In the natural course of events the first of the series of articles on the Fiat plants has reached Turin in the European edition of the *American Machinist*. An official of the Societa Anonima Automobili Ansaldo hos noted that the plants operated by his company are not shown on the map of Turin on page 604, Vol. 60, and has written to our London office as follows:

"In view of the general interest of the automobile industry at large in this series of articles, we feel sure



Map of a section of Turin, Italy, showing Ansaldo plants

that you would like to rectify the omission, thus increasing the accuracy of a very interesting account of the Italian automobile industry. We would like to mention that, next to the Fiat, our plant is the largest in Turin and, likewise, is second only to Fiat in output."

The authors of the Fiat series were, of course, particularly interested in showing the location of the Fiat plants in Turin and, since the locations of the Ansaldo plants were not shown on the map from which the illustration was made, they were inadvertently omitted. The accompanying illustration shows a section of the map previously published, in which the Ansaldo plants are indicated in black.

Abstracts

from other publications

Stainless Steel

Some brief notes on the characteristics and composition of this steel which was discovered about twelve years ago by the Firth Co., Sheffield, England, are given. The difference between stainless and carbon steels is the addition of 12 to 14 per cent chromium. When correctly heat-treated, these steels will definitely resist corrosion of almost any description. It is not necessary to have the steels brilliantly polished before they become entirely stainless, but they are better for this purpose when polished. There is another very important property stated to be of great value to the automobile industry and other industries, and that is high tensile strength at high temperatures. In this respect, they are second only to the best quality high-speed tool steels. Tables are given showing the effect of heat-treatment of this characteristic. In the manufacture of valves from this steel great care must be taken to avoid formation of cold-short between the head and the stem. This is frequently caused by the more rapid cooling of the drawn-down stem in the dies owing to its being of smaller section than the head. Much trouble was experienced originally from this cause. To render this steel in the best condition for machining it should be heated to 700 to 750 deg. C. held at this temperature for about one hour and then allowed to cool in air. If cooled quickly by quenching in oil or water, the resulting softness will not be effected. The steels can be rendered still softer by heating to 860 deg. C. and cooling very slowly. Extreme softness is not desirable as it does not improve the machining qualities. To harden these steels they should be heated to approximately 960 deg. C. and either cooled in air or quenched in oil or water. This high temperature is sufficient to effect the hardening. Among the objections to stainless steel is the cost of obtaining a high polish and the fact that they are hard to machine; this article states they are as easy to machine as 3 per cent nickel or nickel-chrome steel. A further common fallacy is that the mechanical properties of stainless steel are inferior to those of carbon steel, yet the figures given are a sufficient answer to this statement. In England there are several firms manufacturing stainless wire ropes of about 100 tons tensile strength per sq. in.—*The Auto. Engineer*, Eng., July, 1924, p. 201.

Calculating the Stiffness of Shafts

F. A. W. Livermore gives a formula expressed as $K = \frac{d^4}{PRL}$. K is the angle of twist of the shaft, d is the diameter in inches, P the twist force in pounds, R the radius of the twist force in inches, L the length between the arms of twist. Certain tabulations and other formulas are given in this article.—*The Auto Engineer*, Eng., July, 1924, p. 197.

A Foreman Who Dared

By John R. Godfrey

"SAY, Godfrey, here's a hot one," said old man Johnson. "I was in the old engine shop the other day and Bill Harper had a tale of woe as long as one of the Babe's home runs.

" 'What do you think, Johnson,' says he, 'My foreman threatens to walk out on me unless I buy some new machinery. 'Taint wages, by heck, and he ain't kickin about the hours or the color of paint on the office chairs, but—if I don't buy some new lathes and such, he's going somewhere else.

" 'Seems to me,' Bill said, 'If I'm satisfied with paying him what he asks, it's my funeral if the work ain't done as cheap as it might be. But Jim has a different slant on it, and I guess he's going next month. Hate to lose Jim, too—hate it like tunket. He's a dern good man, don't mind when I get mad and cuss a few. Knows his job and can do most anything in the way of getting out work. Seems to me Jim's too dern fussy, and I aint just keen on having him try to dictate to me about running my own shop so I guess I'll have to let him go.'

"So after talking with Bill a while," says Johnson, "I went out in the shop to see Jim. Kinder wanted to get his story because I was a bit knocked off my pins too. Did seem a bit uppish in Jim to hand out an ultimatum like that. And I'm not very keen on ultimatums of any kind. I haven't forgotten the sassy note of ten years ago that came near tying the can to the whole derned civilized world. So I asked Jim to tell me the whole story—and it was a sort of an eye opener to me, J.R.

Jim's Point of View

" 'Mr. Johnson,' he said, 'I'm afraid you can't see this thing from my angle. Perhaps I can't make you, but I'll try.' Says he, 'I've been working for Bill Harper for 15 years and I haven't any special kick coming as to wages—he pays me all he can afford, I guess. In that 15 years he hasn't bought enough new machinery to speak of. I've tried to keep the old tools going and I've fudged up a lot of special tools and fixtures to save time and money, and Harper has appreciated it. But with all these fixin's I can't turn out work as cheap as I'd like, as cheap as I could with new equipment. Harper says he's satisfied—and that I ought to be—but I'm not, Mr. Johnson, and I'll tell you my reason for getting out.

" 'I've got a wife and some kids coming along and I can't afford to be a back number. Unless this shop gets some new equipment, it can't compete with the others and that means that it won't be many years before the sheriff will nail up the door. And where would I be? Even if I can tinker up the old machines and coax 'em to produce more than some, what big concern wants a coaxer and tinkerer for a foreman? They want men who know a modern machine and what it will do. They don't want alibis, they want production. And if I stay here much longer I won't be any use in a modern shop. I've got to keep up to date, Mr. Johnson, if I expect to hold down any worth-while job—and you bet I do. Perhaps you've got a good opening over in your shop—for I know you've got modern equipment there.'

"Of course you know, Godfrey, I couldn't offer him a job—until he quit Harper. That's what we are pleased to call ethics in business, though for the life of me I can't always see it, especially when the other fellow has a man I want. But Jim's line of talk sort of got me going. I was ready to agree with Harper at first, that Jim was mighty uppish and that it was his job to run what Harper gave him. But Jim has several points on his side and I'm inclined to think he's a wise bird after all. As he says, he may be a whiz as a tinkerer but what we want is a man who knows how to handle modern machines.

Losing Money on Obsolete Machinery

"And say, Godfrey, if you could just make every shop manager realize how much money he's losing by trying to get along with obsolete machinery, you'd be doing them a real service. They hang on to an old machine like it owed 'em money—and it's probably been charged off the books for ten years. You'd think some of the old machines were members of the family, they hate to part with them so badly.

"I'm going to get our Congressman to introduce a new bill for taxing the machine equipment in every plant. I'd exempt any new machine the first year, charge 10 per cent the second year, 20 per cent the third, and so on. At the end of ten years I'd have every machine in a production shop condemned for scrap and take it away from 'em. Of course they'd kick, but wouldn't it be the best thing you could do for them?"

The Book of Failures—Discussion

By M. O. Rider

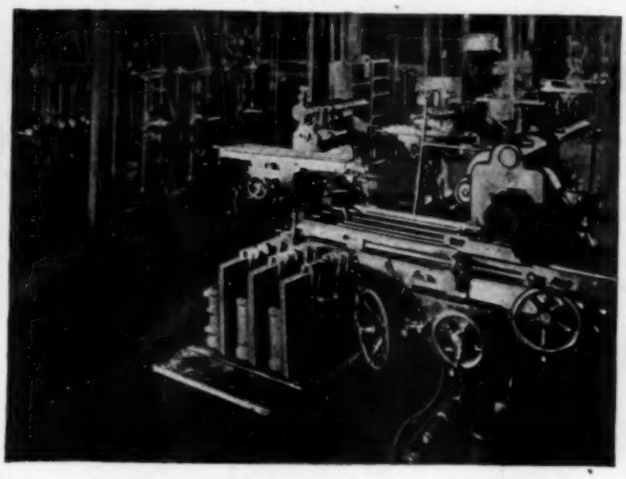
It seems that Tom Johnson's idea in the article "The Book of Failures" appearing on page 198, Vol. 61, of the *American Machinist*, is something that would especially fit the railroad purchasing agent of today. He seems to have lost track of that word quality, which means so much to the material that is used in the construction and upkeep of locomotives. He regards first cost as the ultimate word and the last he will hear from it. Supplies that he buys are the cheapest that can possibly be used.

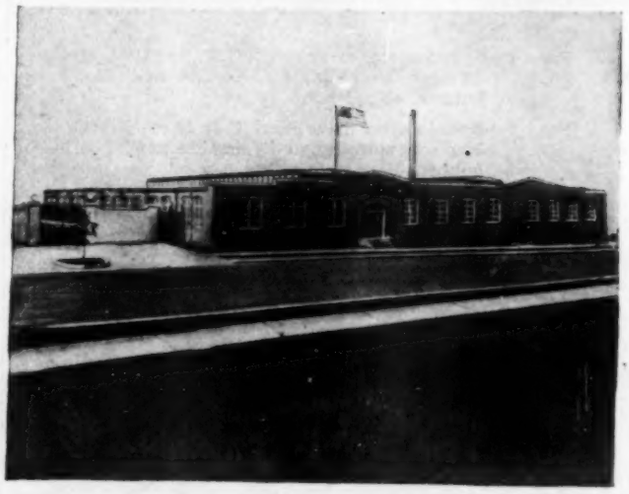
In our shop we are using recut files, and none too good recutting at that. The poor quality is due to the fighting for lower prices. This generation of railroad purchasing agents is trying the same practice with oil that other generations tried and forgot to put down in the "Book of Failures." The purchasing agents are cutting down the oil allotment to a locomotive so that it does not get proper lubrication. They demand lower prices on packing and the manufacturer cuts the grade. Then, because the packing fails to give the mileage it should, it is blamed on the machinist who worked up the glands and joint rings.

Brass is cast off scrap with no new brass and gets worse and worse as it is remelted. The man who gets that piece of brass to machine has to spend much longer on it than he should, and the underground wire reports him for extra time on the job.

Who is blamed? Not the purchasing agent who is responsible, but the man who couldn't get quality-goods to work with gets a black mark opposite his name.

I know that the railroads have a lot of expense and upkeep. But if the purchasing agent will let quality be his first thought, it will cost less in the long run. For quality products are cheaper in the end than those secured by the present method.



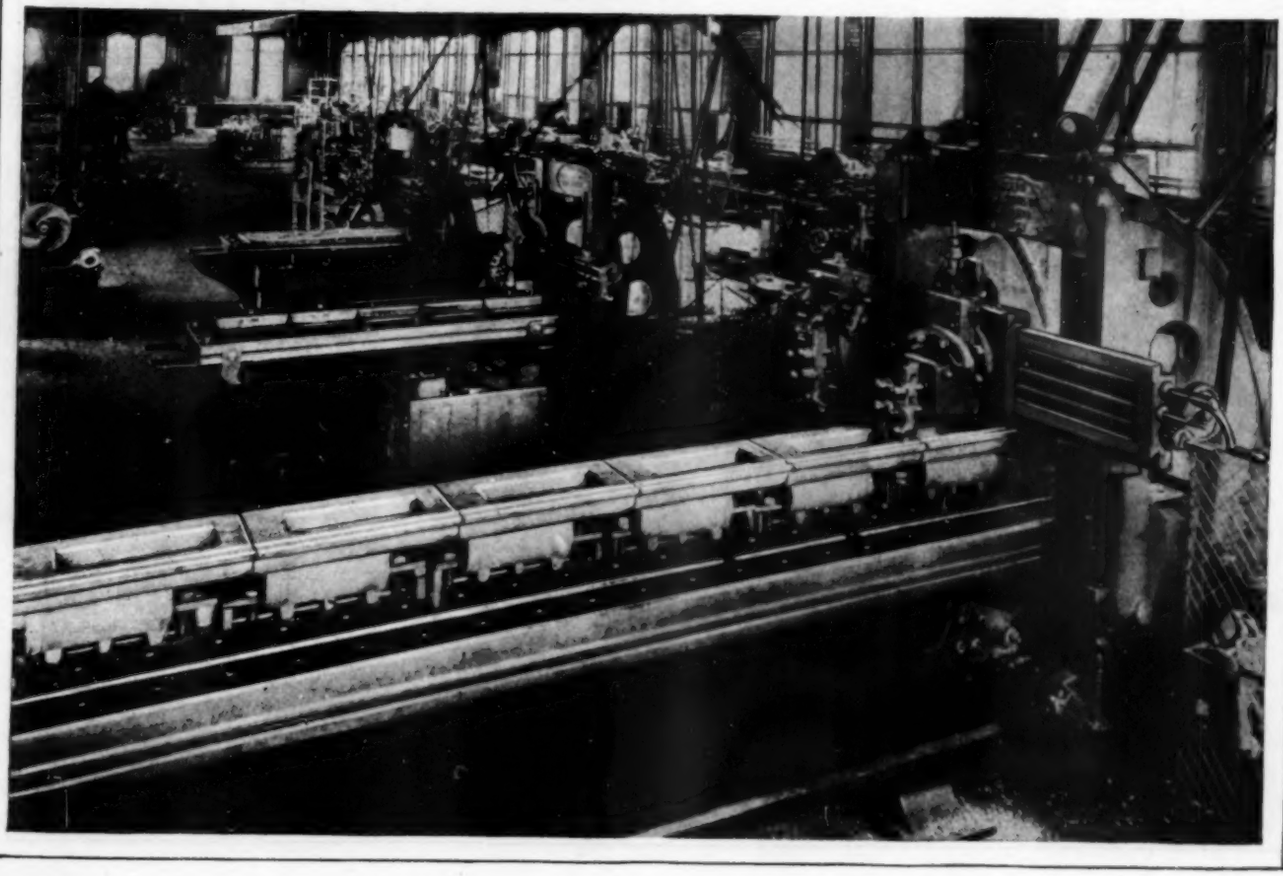


Where Machine Tools Are Made

W. B. Knight Machinery Company

St. Louis, Mo.

Established 1891



What Modern Machine Tools Are Doing

Barber-Colman Hobber

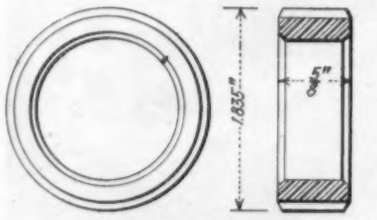


FIG. 1

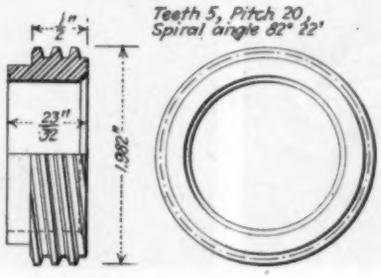


FIG. 2

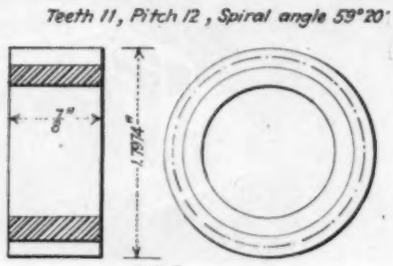


FIG. 3

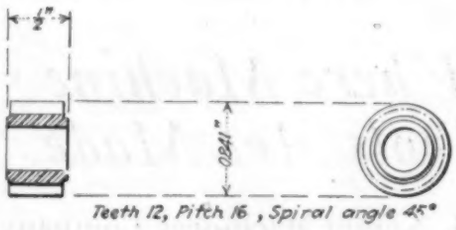


FIG. 4

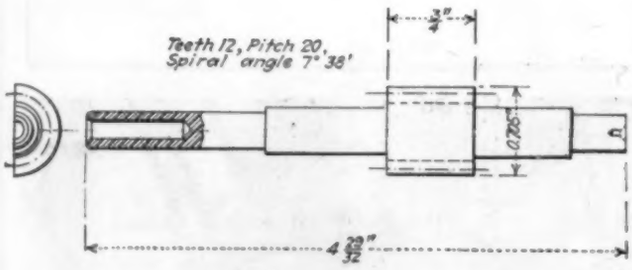


FIG. 5

Fig. 1—Speedometer drive gear. C.R. Steel, 9 teeth, 24 pitch, spiral angle 77 deg. 38 min. No. 3 hobber, 45 per hour.

Fig. 2—Speedometer drive gear. C.R. Steel, 5 teeth, 20 pitch, spiral angle 82 deg. 22 min. No. 3 hobber, 25 per hour.

Fig. 3—Pump drive gear. S.A.E. 1020 steel, 11 teeth 12 pitch, spiral angle 59 deg. 20 min. Finished in one cut on No. 3 hobber with topping hob, 32 per hour.

Fig. 4—Gear. Brass, 12 teeth, 16 pitch, spiral angle 45 deg. No. 3 hobber, 130 per hour.

Fig. 5—Speedometer driven gear. C.R. Steel, 12 teeth, 20 pitch, spiral angle 7 deg. 38 min. No. 3 hobber, 33 per hour.

Fig. 6—Transmission gear. Drop-forged steel, 26 teeth, 7-9 pitch. Roughed with double-thread hob on No. 12 hobber, 35 per hour.

Fig. 7—Transmission-clutch gear. Drop-forged steel 20 teeth, 7-9 pitch. Roughed with double thread hob on No. 12 hobber, 60 per hour.

Fig. 8—Transmission gear S.A.E. 2320 steel, 26 teeth 6-8 pitch. Finish cut on No. 12 hobber, 11 per hour.

Fig. 9—Transmission driving-pinion. S.A.E. 2320 steel. Finish cut on No. 12 hobber, 10 per hour.

Fig. 10—Countershaft reverse-gear. U.M.A. No. 6 Steel, 14 teeth, 7-9 pitch and 14 splines. No. 12 hobber. Splines cut at one pass, 7 per hour. Gear, finish cut, 30 per hour.

Fig. 11—Main transmission drive shaft. U.M.A. No. 4 steel, 10 splines. No. 12 hobber. Long splines roughed 11 per hour, finished 17 per hour. Short splines, 1 cut, 12 per hour.

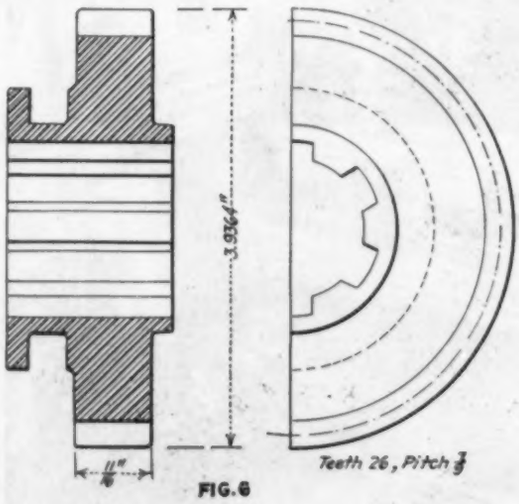


FIG. 6

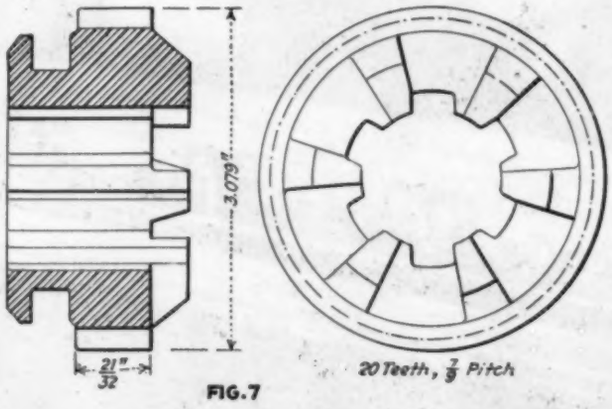
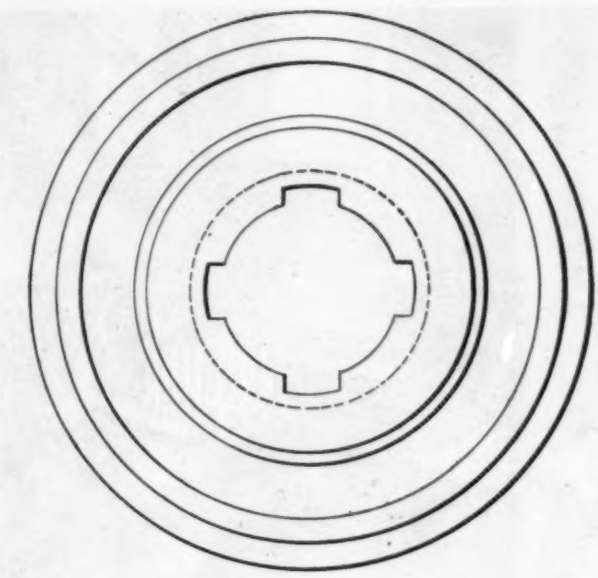
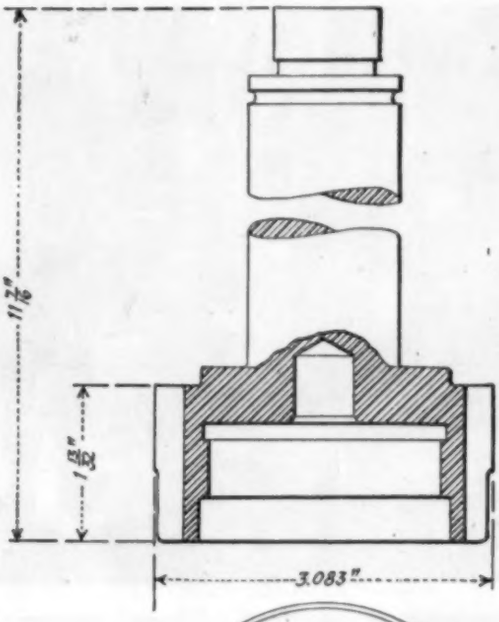


FIG. 7





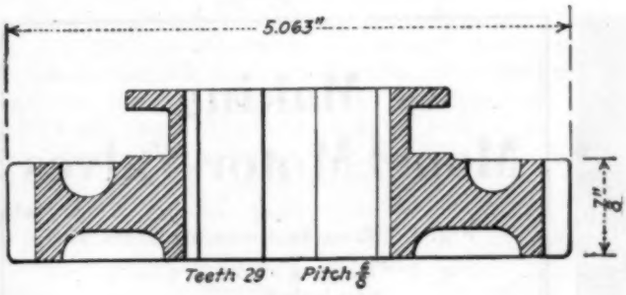


FIG. 8

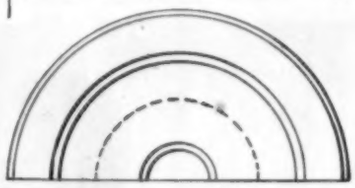
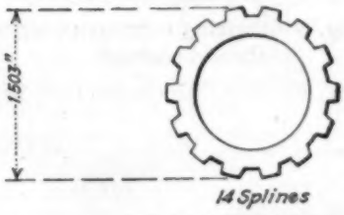


FIG. 9



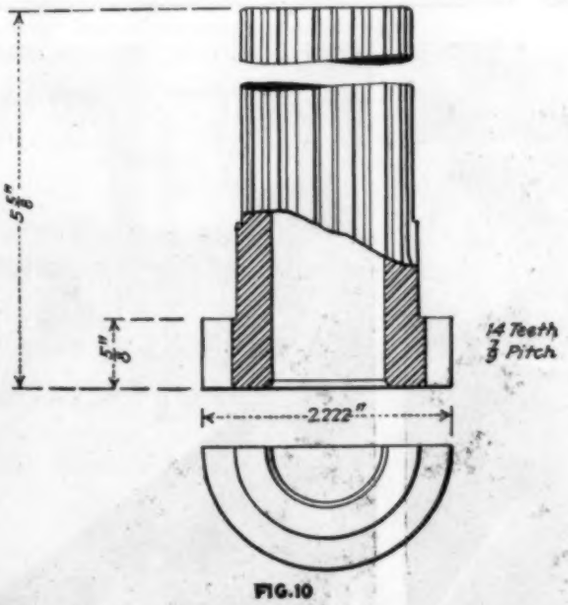


FIG. 10

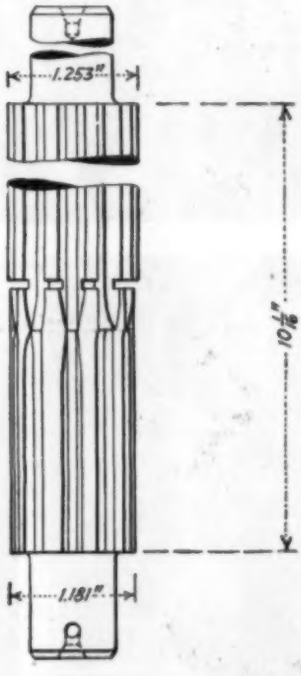
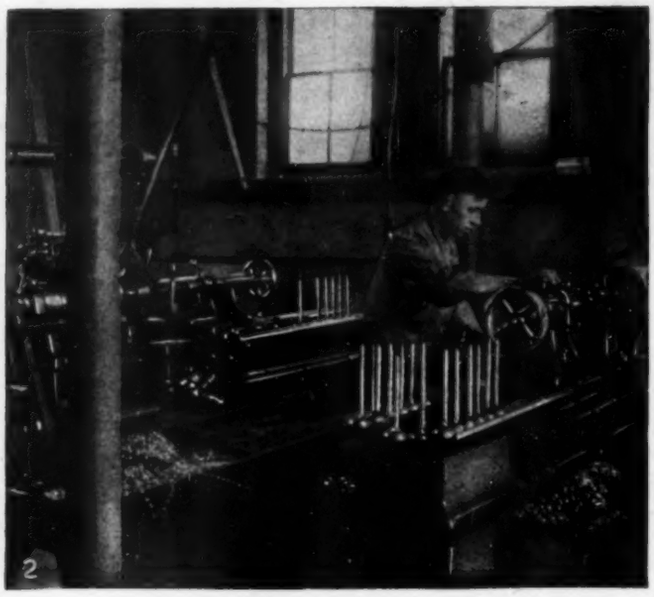


FIG. 11



Making Monel Motor-Valves

Fig. 1—Swaging stems of valves

Fig. 2—Turning stems—running two lathes

Fig. 3—Milling slot in valve head

Fig. 4—Grinding the stems

Fig. 5—Cutting to length with abrasive wheel

Fig. 6—The final inspection bench

Photographs by courtesy of the Oakley Valve Co. of Conn., Inc., Shelton, Conn.

Methods of Machine Tool Design

By A. L. DeLeeuw
Consulting Editor, *American Machinist*

Feed and rapid traverse mechanisms—Arrangement giving combined intermittent feed and rapid traverse—Description of ratchet and pawl mechanism for feed and traverse on a planer

IT IS a simple matter to arrange an ordinary feed mechanism so that it is also capable of giving a quick traverse. All that is necessary is to connect the driving shaft, by means of a clutch, either to a shaft without the intervention of reduction gearing, or else by shifting this clutch connect it to this same shaft through such gearing. An intermittent feed arrangement does not lend itself to such simple treatment. Where an intermittent feed and also a quick traverse is required, it is customary to utilize two shafts—one for the quick traverse and the other for the intermittent feed. The first shaft is driven from a constantly running pulley or other device, while the other shaft gets its motion either from a one-revolution clutch or from a friction device or some kind of feed box such as is used on planers.

However, it is possible to arrange a combined intermittent feed and quick traverse mechanism in such a way that only one driving shaft is used, and the following example is given here, not because it is of general applicability, but because it shows how the most complicated requirements may be met by a single device.

In Fig. 224, *A* is the driving shaft and *B* the driven one. This driven shaft must either be capable of running at relatively high speed in either direction or it must have a variety of feeds at the beginning or end of a stroke. The illustration shows in diagram how this is accomplished. We will assume that the quick traverse speed must be 60 in. per minute and that we wish to have feeds of $\frac{1}{64}$ in., $\frac{1}{32}$ in., $\frac{3}{64}$ in., $\frac{1}{16}$ in., etc.—eight in all.

The driving shaft *A* runs at 200 r.p.m., and drives the left side of a jack-in-the-box through gears *C* and *D*. With the number of teeth as given in the illustration, gear *D* will run at 240 r.p.m. Gear *C* is keyed to shaft *E* and, if clutch *F* is thrown to the left, gear *G* will cause gear *H*, which is the right side of the jack-in-the-box, to also run at 240 r.p.m. in the same direction as gear *D*. Under these conditions, shaft *I* will run at one-half the sum of the speeds of gears *D* and *H*, which is also 240 r.p.m. This shaft *I* drives clutch *J* which, by means of the bevel reverse shown, will cause gear *K* to run at a speed of 240 r.p.m. either right- or left-hand. Gear *K* drives gear *L*, which is keyed to the driven shaft and, if we arrange the rest of the gearing so that one revolution of this shaft causes an advance of $\frac{1}{4}$ in., we find that the elements so far described will give shaft *B* a rapid traverse corresponding to 60 in. per min. in either direction, provided clutch *F* is thrown to the left.

If this clutch *F* is thrown to the right, gear *M* will still drive gear *D* at the rate of 240 r.p.m. The clutch will cause gear *N* to drive gear *O* at the rate of 128 r.p.m. This gear is mounted on a stud or shaft on

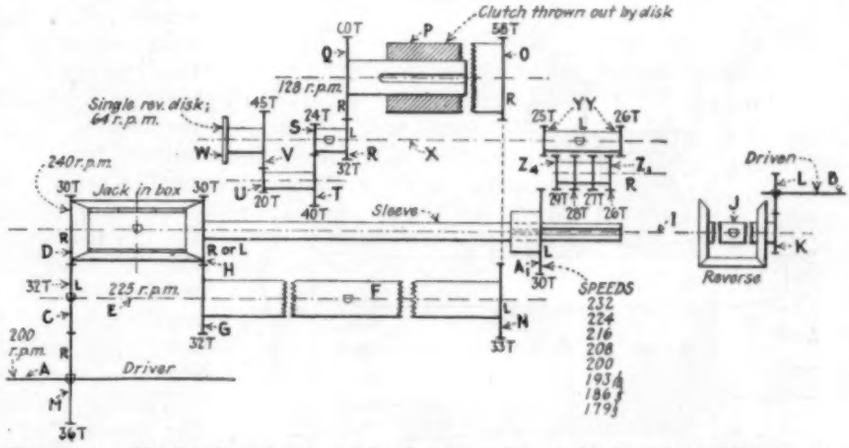


Fig. 224—Mechanism for combined intermittent feed and rapid traverse

which is also mounted a one-revolution clutch; that is to say, a clutch which will throw itself out of action after one or any predetermined number of revolutions. In this case the arrangement is made so that the clutch throws itself out of action after two revolutions. The clutch comes into play only when it is tripped by a dog placed on a convenient element.

We will now see what happens when this clutch *P* engages gear *O*. In the first place, the gear *Q* will revolve and drive gears *R*, *S*, *T*, *U*, and *V*. Mounted on the hub of gear *V* is a disk *W*, so arranged that it will throw clutch *P* out of action at the end of one revolution. How this is done was described in a previous article.

It will be noticed that gear *R* is keyed to shaft *X*, so that this shaft will revolve at a speed of 240 r.p.m. so long as clutch *P* engages gear *O*. Keyed to this shaft *X* is a double gear *YY*, which can slide and engage either gear Z_1 or Z_2, and the nest of gears *Z-Z* will revolve at various speeds according to which of the two gears is engaged. Gear A_1 can slide into engagement with any of the four gears *Z*. It will be

For the author's forthcoming book. All rights reserved. This is the fifteenth article of the series. The fourteenth was concluded on page 343, Vol. 61, No. 9.

noticed that these gears Z differ by only one tooth and, by making the pitch diameter equal to the correct diameter for a gear with 27½ teeth, it is possible to generate them so that all have the same diameter but will mesh properly with the gear A_1 as well as with the double gear YY. In this manner gear A_1 can run at the following speeds:

232	216	200	186⅔
224	208	193⅓	179⅓

It will also be noticed that this gear A_1 is mounted on a sleeve which forms the hub of gear H, so that gear H can also be driven at these eight speeds. If we drive shaft A right-hand, gear D will also run right-hand, but gear H can run right-hand or left-hand, according to whether it gets its motion from gear G or from gear A_1. In the latter event it runs in the opposite direction from gear D. This will cause shaft I to run at a speed equal to one-half the difference of the speeds of gears D and H. The difference between the speeds of these gears is the difference between 240 and 232, or between 240 and 224, or between 240 and 216, etc., the complete series of differences being 8, 16, 24, 32, 40, 46⅔, 53⅓, 60⅔; so that the actual speeds of shaft I will be 4, 8, 12, 16, 20, 23⅓, 26⅔, 30⅓.

However, shaft I runs only during the short period that clutch P engages gear O. This period is equal to

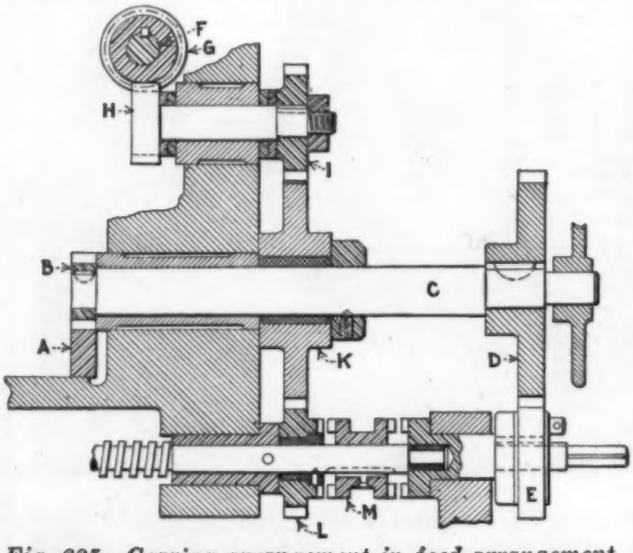


Fig. 225—Gearing arrangement in feed arrangement of a planer

two revolutions of gear O, or $\frac{1}{64}$ min., because gear O makes 128 r.p.m. Confining ourselves to the finest feed —that is, when shaft I makes 4 r.p.m.—we find that this shaft will make $\frac{4}{64}$ or $\frac{1}{16}$ of a revolution. Since one revolution of shaft I will cause a feed of $\frac{1}{4}$ in., $\frac{1}{16}$ of a revolution of that shaft will cause a feed of $\frac{1}{64}$ in. The other feeds can now be easily figured from the speed of shaft I. For instance, the second speed of that shaft is twice as great as the first and the feed will be $\frac{2}{64}$ or $\frac{1}{32}$ inch.

There are, in this system, two clutches which can be operated by hand, namely, F and J. The operation of clutch F will give either quick traverse or intermittent feed, and operating clutch J will change the direction of the feed. An arrangement of this kind would be useful only where one machine member needs to be traversed at a time. This is the case, for instance, with a slotter, the main elements of which are the table, the saddle, and the slide on the column. The table has a rotary motion, the saddle has a movement across the machine, and the column slide has a movement in the direction of the axis of the machine. Any of these movements may be the feed or the quick traverse but, except in exceedingly rare cases, two of these movements are not used at the same time.

With a planer, on the other hand, conditions may be different. One might want to feed downward with the tool slide of one head, while using at the same time the quick traverse for another head. Furthermore, it might be possible that both heads are feeding but that, on account of the nature of the cut or of the work, one must feed slower than the other. Neither of the arrangements described before would entirely fill such requirements. In order to have the feeds and the quick traverse of the cross-rail heads as well as those of the slide heads entirely independent of each other, it would be necessary to have a completely independent feed system for each of these heads, each of these systems having its own quick traverse. Such an arrangement would be exceedingly complicated and it would only be permissible for the largest sizes of planers. On very large machinery the possibility of having independent and rapid movements of the different elements becomes of much greater importance than on smaller machines but, at the same time, the cost of a certain amount of mechanism is a much smaller fraction of the total cost of the machine. In other words, the advantage becomes a greater percentage while the price becomes a smaller percentage. It would therefore be permissible to consider such fully worked out mechanisms for the largest types of machines. On the smaller types a compromise must be reached.

On many planers no provision is made for power feed for the tool slides of the side heads. Neither is there any provision for their quick traverse, so the simple mechanism of a slotted crank is sufficient for all the requirements of side heads. The cross-rail heads may have their individual feeds and quick traverse. Many other arrangements might be made as compromise.

Various arrangements have been made to regulate the amount of intermittent feed. We have made the acquaintance of the slotted crank and the change gear device in connection with the jack-in-the-box, but the most common device is the ratchet and pawl. Ratchet and pawl devices are made either reversible or non-reversible. The ordinary ratchet and pawl construction is too well known to require description here. The chief limitation in the use of this device lies in the fact that a pawl will advance the ratchet an integer number of teeth. The smallest number of teeth which can be advanced is 1 and the next number is 2, so that there can be no fine gradation in the lower range of feeds. It would, of course, be possible to make the ratchet feed very fine, so that the lowest feed used would still require a number of ratchet teeth—let us say 4. In that case the next feed would be 5. However, if fine teeth are used in the ratchet, both pawl and ratchet will be of weak construction and this makes it impossible to use the fine ratchet except for light machinery.

When a finer gradation of feed is required for heavier machinery, a number of pawls one behind the other are used, or else a number of ratchets, each with its own pawl, are placed on the same shaft. In the first case the pawls are spaced in such a manner that the

space of the ratchet teeth is evenly divided. If, for instance, pawl No. 1 were in full engagement, pawl No. 2 would be ¼ of a space behind; pawl No. 3, ½; and pawl No. 4, ¾. If a number of ratchets were used, they would be so keyed to their common shaft that the space between two teeth would be divided by four or, generally speaking, by whatever number of ratchets employed. In this case the pawls would be all in line with each other. In the ratchet and pawl construction either one may be the driving member.

Where a pawl drives a ratchet, it is possible either to limit the amount of movement of the pawl by some device such as, for instance, the slotted crank, or else give the pawl a constant amount of movement and makes its effect on the ratchet variable by some other means. The most commonly used means for this purpose is a shield over the ratchet. As the arm carrying the pawl swings back and forth, the pawl will engage the ratchet until a pin or roller mounted on the pawl is lifted by a stationary shield. In this manner it is possible to advance the ratchet as many teeth as desired within the range of the space of the pawl.

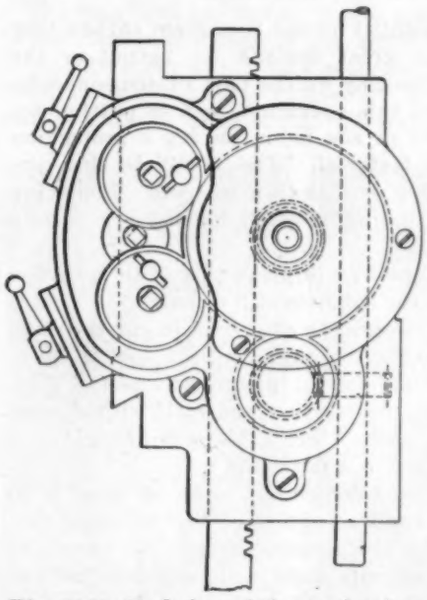


Fig. 226—End view of the mechanism shown in Fig. 225

In Figs. 225 and 226 are shown a gear development and an end view, respectively, of the quick traverse and feed device applied to the end of the cross rail on some of the planers of the Cincinnati Planer Co. The sketches should be considered as merely illustrating the principle of construction and the general way of execution, but not as containing detail information as to dimensions and proportions. In Fig. 225, *A* is the rack which obtains a certain amount of up and down movement from the slotted crank of the feed box and transmits its movement through pinion *B*, shaft *C*, and gear *D* to click-box *E*. This click-box has its own bearing in the casting and is not directly connected to the feed screw which it is to drive. *F* is the quick traverse shaft which runs up and down behind the cross rail and can be run in either direction by means of some reversing mechanism. In this particular instance this reversing mechanism is operated by means of a handle located at the cross rail and not shown in the sketch. This handle operates a rod which is also run up and down and behind the cross rail. By means of suitable connections the reversal is effected when this handle is moved to the right or left. The shaft *F*, through gears *G* and *H*, pinion *I* and idler *K*, drives the gear *L* which runs loose on the feed screw. The click-box *E* and gear *L* can be connected to the feed screw at will by shifting the clutch *M*.

Particular attention is called to the manner in which the clutch may be connected to either the quick traverse or the intermittent feed. If the clutch shaft were constructed in the ordinary manner—that is, with the clutch keyed to it and the two gears *E* and *L* running on it—the square end of the shaft would revolve at high speed when the quick traverse is thrown in. This might lead to accidents if the crank should happen to be on the square end of the shaft. In this construction, the clutch shaft bears in an enlarged part of the shaft on which the click-box is located, so that neither click-box nor the square part of the shaft turns with the quick traverse. In other words, the crank will stand still when the quick traverse is in.

In a construction as shown here the rack has a variable amount of movement. Other constructions for the same purpose employ a rack or shaft with a constant amount of movement and provide for the necessary variation of feed by a slotted crank carried at the end of the cross rail. There is, of course, an endless number of ways in which the object of the construction may be reached, but the foregoing will show the points that must be kept in mind and how the problem can be solved.

Some Causes of Cracks and Soft Spots in Hardened Work

By J. C. Spence
Works Manager, Norton Company, Grinding Machine Division

Reprinted from *Grits and Grinds*

IT IS nearly always the case that when there is trouble in production, the operation at which the trouble is found is blamed. Grinding usually being the final operation, is therefore liable to be blamed for nearly all the errors of judgment. This fact should be kept in mind and judgment reserved until the situation has been thoroughly canvassed and the real cause of the difficulty located.

Following are a few cases that illustrate this point and show where some of the trouble in grinding hardened work really originates and how the facts may be proved to the satisfaction of all concerned.

Soft Spots

If soft spots are due to the wheel, there will be evidence of burning at some stage of the operation. Usually this defect occurs only in irregular work such as cam grinding where there is a decided change of work speed at different points in the contour. Cams having long flats are more likely to be burned than are cams having convex lifts. However, there are cases where it is well to ask yourself how a wheel can select one spot in a contour to soften it and not treat the remainder of the contour in the same way.

Mark the soft spot and then reharden the piece. If the spot is still soft you have proof that there was not enough carbon at that place; in other words, it was a case of defective carbonizing. Sometimes, however, a piece may be properly carbonized but not properly quenched or else quenched in oily water or held improperly with the tongs. In any of these cases rehardening will cure the soft spot and it then remains for you to regrind and test this spot in order to finally prove that the wheel did not cause it.

Entire Surface Soft

If the surface is really soft for an indefinite depth and not just skin soft, it is almost a foregone conclu-

sion that the piece was not carbonized to a depth equal to the amount of stock removed. Careful grinding with a free cutting wheel (perhaps obtained by coarse truing) will enable you to show at what point the case-hardening begins to disappear. Further and conclusive proof is to reharden the piece. If it is soft after quenching it was never properly carbonized.

Skin Softness

There should be a difference recognized between the real skin-softness and the apparent one that is the result of coarse wheel-truing. When a wheel is trued coarse, the resulting surface on the work is composed of microscopic pyramids. If these were enlarged they would resemble the diamond checking on a gun stock. When a hard file is brushed over these the area of contact between file teeth and tops of the pyramids is so infinitesimally small that the resulting pressure per unit area is very great and stock is removed in spite of the fact that the pyramids individually are hard. It is simply a question of which is stronger, the file teeth or the pyramids. After the first brush of the file you are down to a real surface and the work appears to be hard.

True skin-softness can result from several causes:

(a) Too high wheel-speed
(b) Too slow work-speed
(c) Loaded wheel
(d) Glazed wheel
(e) Improper work-cooling
(f) Too much wheel-feed
(g) Too little wheel-feed

Skin softness is simply a modified burn.

Experiments will always enable you to overcome this trouble but we should all bear in mind that grinding does not give a perfect surface, absolutely free from microscopic pyramids and that this kind of surface can be obtained only by intelligent use of lapping.

Cracks in Hardened Work

Cracks are more likely to occur under high-pressure production methods if the heat treatment has been careless.

It has been found in the case of piston pins, for instance, that if the pins, after hardening, are drawn to a point that does not affect their hardness, say 350 deg. F., cracking will not occur even when grinding is carried on very fast.

Cracks are usually due to grinding with a "loaded" wheel. The wheel becomes loaded by the operator taking off the bulk of the stock so rapidly that particles of steel cling to the pores of the wheel face, with the result that great local heat is generated with cracks resulting.

The proof of this is to grind the cams with a free cutting wheel, say 36 J Alundum, with a feed of 0.0005 in. on diameter per revolution. There will be no cracks provided the work speed is not too slow.

Cam grinding and surface grinding produce more complaints of cracks than are found in cylindrical grinding, because of the greater wheel contact on the flat sides of a cam or surface grinding job. In addition, cams have to be rotated very slowly because of the necessity of having the master cam follow the roller accurately. This need for accuracy and fine finish sometimes compels a r.p.m. of 9 or 10 and as the heel of such a cam is only about 1.250 in. diameter, the average surface speed is almost 4 ft. per min. Since, to avoid cracks in hardened work ordinarily requires a surface speed of about 50 ft. per min., it will be seen that extreme care is needed in cam grinding.

In addition to this difficulty, it must be remembered that steel, especially if plunged at too high a temperature, is in a very unstable physical condition and will often explode from apparently no external cause. We are dealing with greater forces than most people realize and should use judgment accordingly. Cracks can be caused by a condition in grinding which brings about sudden, localized heat and the same cautions concerning burning will apply here also.

Improper Carbonizing

In the case of quantity production from carbonizing furnaces, either the great demand for output or the mistaken ideas of economy on the part of someone who does not look beyond this operation, lead to putting too many pieces in a box or else using too big a proportion of old carbonizing material. The result is that the case is uniformly thin or it is thin in spots. Following these results the grinding is often blamed for defects in the articles.

As stated above, one way to prove this is to reharden the piece and see if the softness still remains.

Another way to prove depth of case is to cut the piece in two at a cross section through the soft spot in question, by means of an elastic grinding wheel. Then carefully polish the cross section and etch with a solution of nitric acid and water. The etching acid will show the depth of case by a dark line.

Still another way to determine depth of case is to carefully grind by hand a portion of the hardened surface before it is machine ground at all. If the hand grinding is continued only until a file will take hold of the metal at the bottom of the cut, then it is evident that the depth of the case has been reached and this can be measured accurately.

Dry Grinding

Much work is spoiled by attempting to surface-grind dry. High-speed steel gives the greatest trouble, although any kind of hardened work has possibilities of cracking.

The use of softer wheels and less feed is usually the answer, although there have been cases where the feed was so fine that the wheel was not clearing itself, but was just glazing. The best remedy, however, is a modern, precision surface-grinding machine with a sufficient supply of grinding compound.

In general then we must remember that cracks and soft spots can come from the use of the wrong wheel or the wrong use of the right wheel, but are generally due to causes other than grinding.

Production of Files in 1923

The Department of Commerce announces that, according to reports for the biennial census of manufactures, 1923, the establishments engaged primarily in the manufacture of files and rasps in that year reported such products valued at $11,361,939, together with other classes of products valued at $256,629, making a total of $11,618,568. The rate of increase represented by this total as compared with 1921, the last preceding census year, was 51.9 per cent.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Handling Frame Binders

BY FRANK MCGOUGH

The weight of locomotive frame binders has increased to such an extent that it has become quite a problem to handle them easily and economically. In order to facilitate the handling of binders and make it a one-man job, the lifter shown in the accompanying illustration was made in the Santa Fé shops at Albuquerque, N. M.

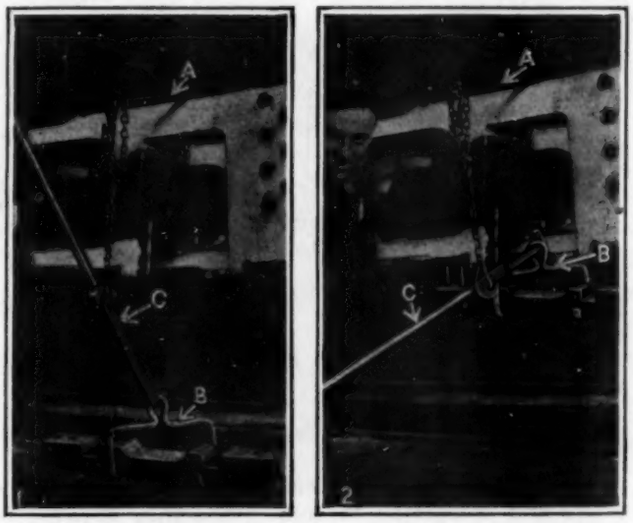


Fig. 1—Ready to lift the binder. Fig. 2—Binder lifted nearly into position

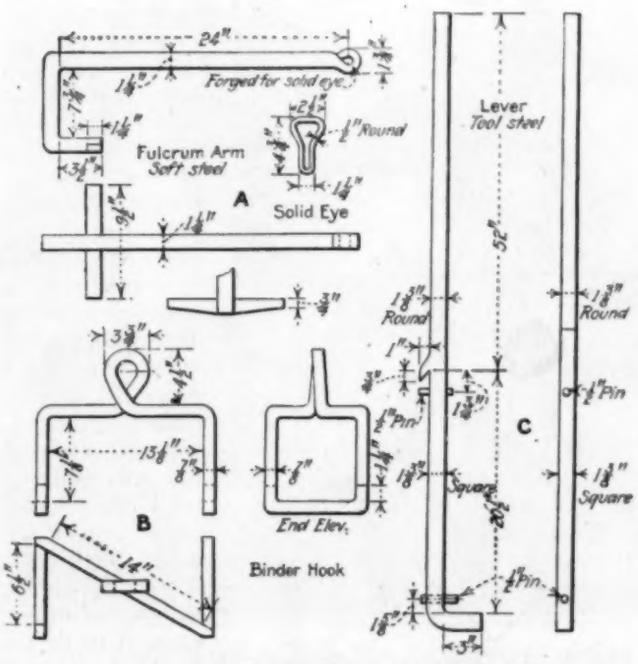


Fig. 3—Details of the lifting apparatus

The apparatus may be said to consist of three parts in addition to the chains. The hook or fulcrum arm *A* goes over the top of the frame as can be seen in Figs. 1 and 2. The binder hook *B* is shown in detail in Fig. 3, and is of 1¼-in. square stock bent up into a sort of double ended Z-shaped hook with an eye in the center. The third member is the bar or lever *C*, which is preferably made of high-carbon steel in order to secure strength with lightness.

It will be noted that the hook end of the bar is made square while the other end is round. There is a hook 20½ in. from the end for the eye on the lower end of the chain, and a pin to prevent the chain from slipping out of position. A similar pin is provided near the end hook to hold the lifter in position and prevent it from sliding as the bar is raised to an acute angle.

In Fig. 1, the apparatus is shown in place with a binder in the hook ready to be lifted, and in Fig. 2 the binder has been lifted nearly into position. The latter illustration shows how the hook goes up inside the frame jaws or pedestal, and enables the binder to be held firmly in position while it is being bolted into place.

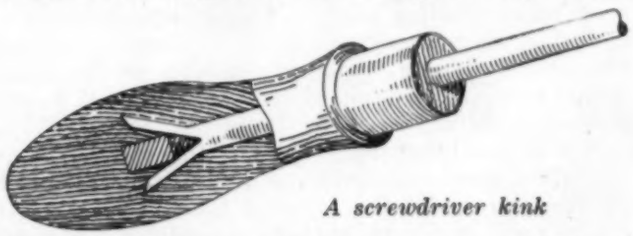
Holding a Screwdriver in Its Handle

BY JOHN SMITH

Surrey, England

A simple but effective method of securing a screwdriver in its handle is shown in the appended sketch.

The shank of the tool is turned to a given diameter, slotted at the end and the inner corners of the slot bevelled to an angle of about 30 deg. so as to leave a



A screwdriver kink

sharp knife-edge at each outer corner. A hole is drilled in the handle in which the shank of the screwdriver will drive fairly tight.

A round plug of steel, of the same diameter as the shank and cone-pointed at one end, is driven to the bottom of the hole in the handle with the pointed end outward. The screwdriver is then driven in, and when the slotted end comes in contact with the pointed end of the plug the sides will spread and each half become firmly embedded in the wood.

The dimensions are so calculated that when the tool has been driven in as far as it should go, the shoulder of the shank will abut against the ferrule of the handle.

Babbitting Cast Iron—Discussion

By E. Andrews
Manchester, England

I have read with interest the articles under the title given above and published on pages 447 and 819, Vol. 60, of the *American Machinist*, and believe that a few practical hints from one who has babbitted many bearings may be of value to the readers.

The job of babbitting cast iron is by no means as simple as it appears. Each step must be well understood and properly executed in order to obtain the best results. Experience has shown me that all cast-iron bearings that are to have a babbitt lining should be well tinned before the babbitt is poured, and, as the tinning process is not as well understood as it should be, the writer will outline briefly the method that he employs and would recommend.

In the first place the surface of the iron must be chemically clean—that is, free from sand, grease, rust or dirt of any kind—and the best way to secure this condition is to immerse the casting in a pickle of hydro-fluoric acid consisting of about fifteen parts of water to one of acid. Hydro-fluoric acid is preferable to muriatic or sulphuric acids, commonly employed for the purpose, for the reason that it dissolves the sand instead of merely dislodging it, and does not attack the iron to the extent that the other acids do. The pickle should be kept warm by means of a jet of steam; a temperature ranging from 150 to 170 deg. F. being most desirable.

The bearings should be examined occasionally while in the pickle and any sand or black spots on the surface of the iron removed by means of a stiff wire brush. Care must be exercised to avoid overpickling, as this will cause pitting of the surface. The length of time that the bearings should remain in the pickle will depend somewhat upon the strength of the acid and the temperature of the bath. The bearings should be rinsed thoroughly in clean water after pickling.

Parts of the casting that are not to be tinned should be coated with a thin mixture of graphite and water. When dry, apply sal-ammoniac to the surfaces to be tinned and immerse the bearings in a bath of molten metal consisting of equal parts of tin and lead. Babbitt metal should not be used for tinning because it has a much higher melting point, making it difficult to maintain a molten film on the surface. The bath of tinning alloy should have a layer of sal-ammoniac on top of the metal, where in addition to serving as a flux, it will prevent oxidation.

It is essential that the molten metal be maintained at a constant temperature, since if proper attention is not given to this point the repeated introduction of cold castings will soon cause the bath to solidify. The bearing should be allowed to remain in the molten metal until it is hot enough for the tinning alloy to run off freely, leaving a thin coating on the surface.

It is preferable to babbitt the bearing immediately after the tinning and before it loses the heat acquired in the tinning bath. Important items to be watched in the babbitting are, to maintain the temperature of the babbitt between 460 and 470 deg. C., and to use a ladle that will not allow dross to get into the cast. In the interest of utility as well as of economy, the babbitt linings should be as thin as possible.

Experience has shown that a perfectly good babbitt can be made worthless by allowing it to become too hot, or by pouring it too hot or too cold; this applying more to a lead base than to a tin-base mixture.

For the motor bearings of automobiles, strength and toughness are the two most important factors in babbitt metal. A strong metal may be hard in character, while a tough metal is ductile. The former will carry a heavier load, and, ordinarily, at a higher coefficient of friction than the latter. When the load is accompanied by shocks, jolts or vibration the strong, hard metal will be likely to crystallize and break up, while the tough, ductile metal will sustain severe shocks with but little damage.

Need for an Isometric Scale

By C. E. Josselyn

It seems strange that manufacturers of drawing instruments have not placed on the market an isometric projection scale. Because of the lack of such a scale,

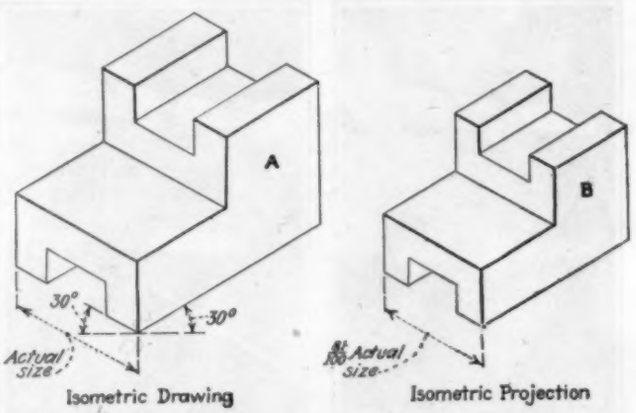


Fig. 1—Comparison of isometric drawing model

draftsmen are oftentimes compelled to use an ordinary scale; first measuring the object and then drawing it to the same scale. This method does not, of course, give a true appearance, the drawing being much larger than the object as actually viewed.

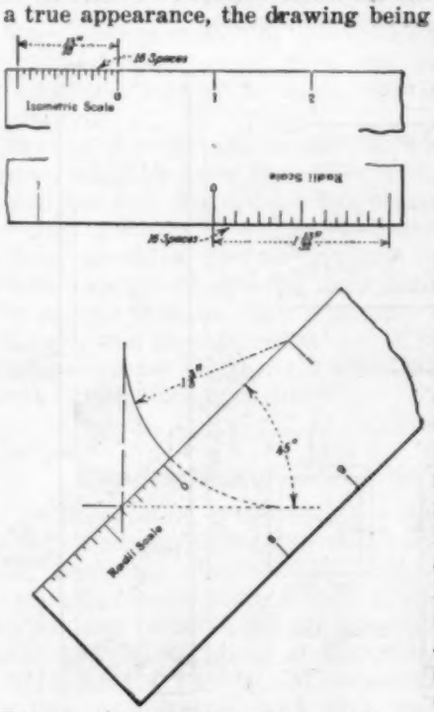


Fig. 2—An isometric scale made of drawing paper

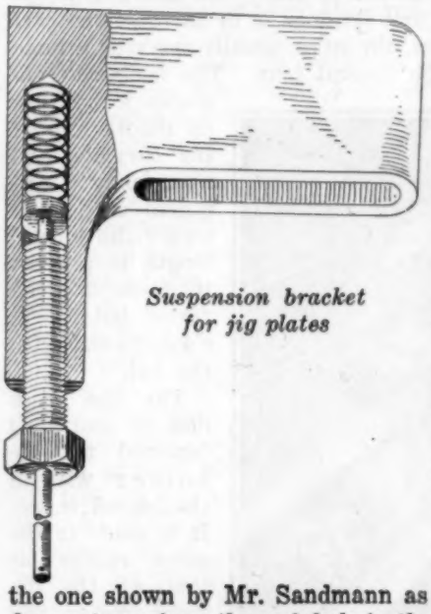
A true relation can be obtained by using an isometric scale made in the proportion of 0.81, or approximately 13/16, to the inch. The object is then measured with a standard scale but drawn to the reduced one. All measurements are made on the isometric lines: that is, the vertical and the 30-deg. lines. A comparison of the sketches *A* and *B*, Fig. 1, shows the difference. *A* being the drawing and *B* the model.

For several years I have used a scale graduated as shown in Fig. 2. and made of Whatman's drawing paper, and it is still serviceable. Along the opposite edge are placed radii divisions which serve readily to locate on the 45-deg. lines the center of any radius coming within its range. The scale "inch," though indicated as 1⅓ in., is actually 1.414 in., the scant of 45 degrees.

Suspension Brackets for Jig-Plates —Discussion

By Alfred T. Gregory

On page 517, Vol. 60, of the *American Machinist*, there is an article under the title given above, in which W. F. Sandmann describes and illustrates some suspension brackets to be used in connection with jig-plates on drill presses. While I have no specific criticism to offer with respect to the designs presented by Mr. Sandmann, I am here submitting a sketch of a similar bracket in the hope that it may possibly be considered an improvement over his designs.



Suspension bracket for jig plates

The construction of this bracket is very much like the one shown by Mr. Sandmann as his Fig. 3, but it does not require a through hole in the casting or forging that must be plugged up with a stopscrew, it is accessible at all times and in all positions, and it has the further advantage that it provides ample range of vertical adjustment without the necessity for making longer rods.

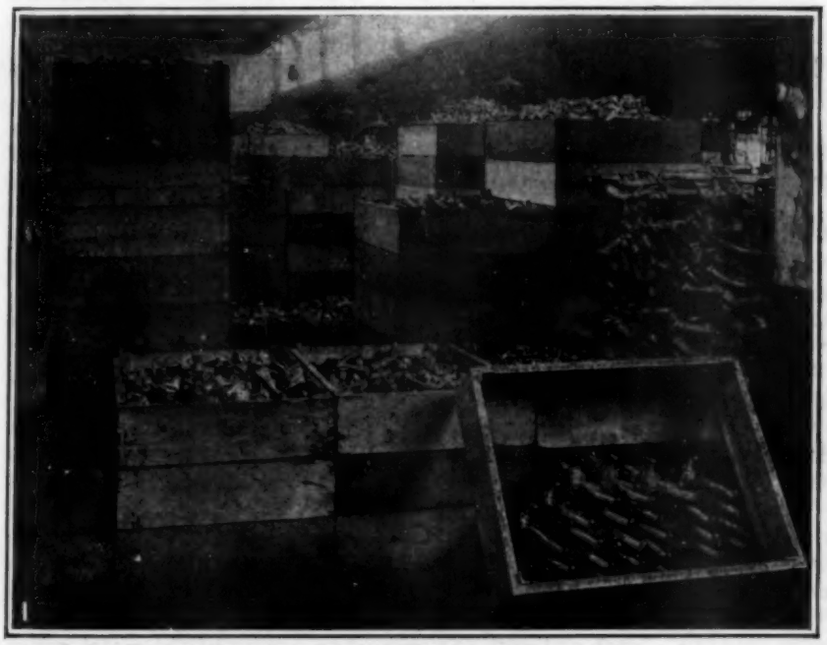
If, for any reason, the range of adjustment as shown by the sketch should not be considered sufficient, it is an easy matter to make the threaded bushing through which the rod passes as much longer as may be desired. If it is made very much longer, however, it would probably be advisable to provide a locking nut on the bushing in order to secure the latter against possible accidental displacement by reason of the constant jarring to which it is necessarily subjected in action.

Bottomless Bins for Stock Storage

By A. A. Brown
Superintendent of Materials, Chandler Motor Car Co.

Handling and storing parts in process is always a problem in large production plants. The motor shop-truck has helped to solve many problems relating to handling, but storage methods are still far from being standardized. The Chandler Motor Car Co., has adopted the type of storage bin shown herewith. The bin consists of a set of frames of 2x10-in. plank, reinforced at each corner by a piece of 2x2½-in. angle iron. The angles project at the tops and no not reach the bottoms of the frames, so that the frames may be stacked to any desired height and kept in alignment, as may be seen in Figs. 1 and 2. The frames are 42x60 in., these dimensions having been selected as being best suited to our needs although they can be made any other size. The frames are readily made and are substantial enough to hold heavy parts.

In Fig. 1 are shown tiers of 2, 3, 6 and 9 frames, used for work of various kinds. The height is increased as required and the upper frames removed as the contents are used, the flexibility of the bins being quite an advantage. The bins shown are in the rough-stock department and their particular advantage lies in the ease with which the sections can be moved and built up in other locations as occasion demands.



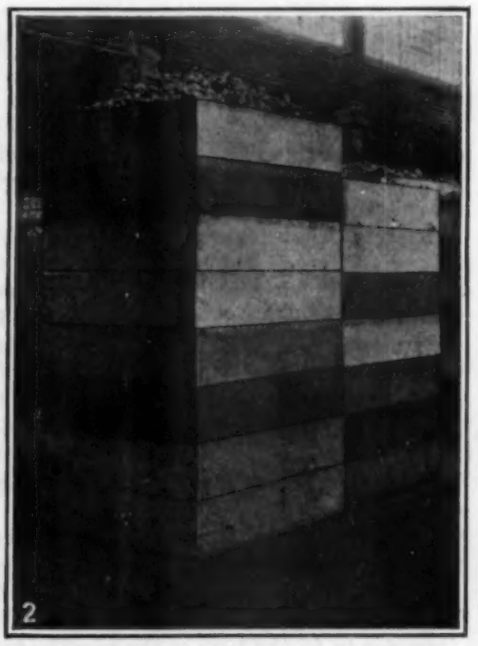


Fig. 1—Sectional storage bins in Chandler plant. Fig. 2—A stack of frames for large quantities of work

A Large Screw Repaired by Acetylene Welding

By William J. Fisher, Jr.

A large screw, cut with right- and left-hand threads, and part of the equipment of a special machine, had become so badly damaged as to render it unserviceable. To shut down the machine long enough to make or procure a new screw would have curtailed production to such an extent that it could not be considered except as a last resort. We therefore decided to make a repair that would enable the machine to continue in service.

The damage was to the corners and edges of the diamond-shaped blocks formed by the crossing of the threads, which had become broken down so that the reversing nut would not pass, and we built them up by means of the acetylene torch until they were a trifle over the original size. The screw, which was about 20 ft. long was taken to a large lathe where it was straightened to take out the distortion caused by the local application of heat, and the threads were then redressed by means of a toolpost grinder, used as a threading tool.

The time and cost of making the repair was inconsiderable, compared to replacing the screw with a new one, and the performance of the repaired screw has been quite satisfactory in every way.

A Handy Stud-Arbor for Small Work

By Amos Ferber

There have been illustrated recently in the *American Machinist* a number of small stud-arbors, or expanding chucks, each of which was designed to be expanded in the bore of the work by means of an internal wedge that was either to be drawn or driven into a correspondingly tapered hole passing axially through the arbor. While this scheme is quite practical, the central hole subtracts from the strength of the device, and it is

A stud-arbor without a center hole

obvious that the arbor would be stronger if there were no hole through it. The factor of safety decreases very sharply toward the small sizes.

There is shown herewith an arbor that has no hole through it, yet it holds the work quite firmly and, like the tools above mentioned, will hold any size within reason for which a bushing is made. The device consists merely of a piece of round steel tapered on one end to fit the spindle of the lathe in which it is to be used and on the other to about a 5-deg. included angle; the size and length of this end being made with respect to the dimensions of the bore of the work likely to be held by it. It is, so far, exactly like the shank of a drill chuck.

The large end of the short taper is necessarily smaller than the bore of the work; the difference being made up by the complementary part, a split bushing, which has a tapered hole to fit the shank and is of an outside diameter to fill the bore of the piece to be held.

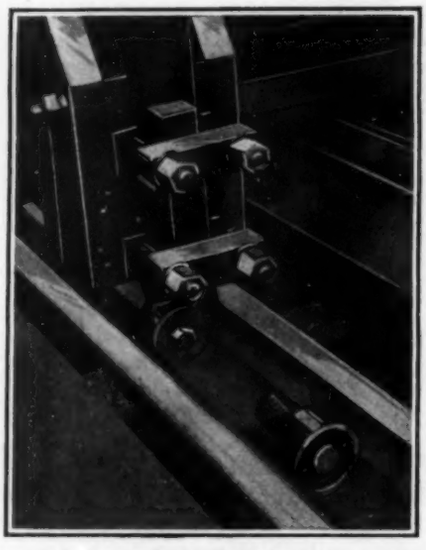
To put a piece of work on the arbor the split bushing is placed in the bore, the bushing and work placed on the taper, and the whole struck a smart blow with the palm of the hand; or with a lead hammer if the work must be held extra tight. The tapered stud expands the bushing in the bore of the work, which is held as firmly as would be a drill chuck with the same sized shank.

For thin work, as washers that are to be faced on both sides, the bushing should be made with a shoulder on one end. By making a stepped bushing, several sizes can be accommodated upon one bushing.

Disk Tool and Gage for Planing Groove

By William Denton

The illustration shows a tool that is used for finishing the trough in the bed of a large roll-grinding machine in which the leadscrew lies. The screw is about 3½ in. in diameter and its duty is to traverse the carriage of the machine, the latter usually carrying a huge roll that may weigh several tons. The leadscrew engages a half-nut on the bottom of the carriage and necessarily requires support over its entire length to prevent it from being forced out of engagement with the nut.



A disk tool for planing grooves

The tool is a disk of tool steel fastened to the holder with a shouldered screw. It is made to the same radius as that of the desired groove and is ground to size. Any amount of relief can be given in this way to suit the material to be cut.

Top rake is provided by a groove sunk into the face of the disk while it is being forged. As a final operation, the blacksmith lays the disk face upward on the anvil of the steam hammer, places a steel ring of round section concentrically over it and strikes it a blow with the hammer. This sinks a groove into the face of the disk corresponding to the lower third of the ring section so that, when ground after hardening, the cutting edge presents an appreciable rake.

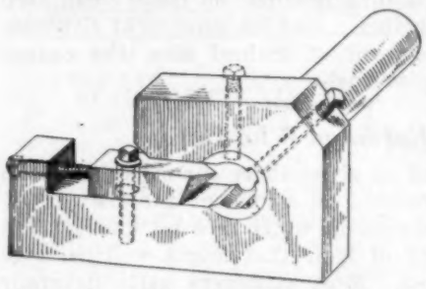
When the lower half of the tool has become dull from use the screw is loosened and the disk turned half-way over, presenting a new cutting edge. When this half, too, is dull the tool is taken to the blacksmith shop for rehardening, and while it is hot the same ring that was used in forging it is placed in position and a blow struck, thus swelling out the periphery to allow stock for regrinding to size.

The manner of using the gage shown in this groove ahead of the tool is obvious. Being of the same diameter as the tool it will fit the groove anywhere. A diametrical line across the face shows, by coinciding at each end with the corners presented by the metal, when the depth of the groove is equal to the radius.

A Useful Kink in Box-Tool Bushings

By F. W. Bach

In getting out some work on a hand screw machine I had trouble with the bushing of the box-tool, which bushing was of the usual type with a part of the wall cut away to allow room for the turning tool. Dirt or fine particles of metal would persist in getting into the bushing along with the work being turnned, causing the latter to bind and heat up, which still further aggravated the the trouble by roughing up the smooth surface that the work was required to present.



Kink in making box-tool bushings

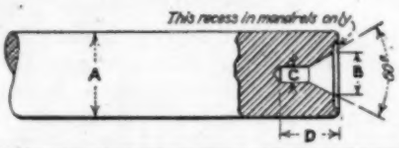
To overcome the trouble I cut away portions of the bushing as shown by the sketch, so that the work would bear only upon three points of contact. This relieved the trouble somewhat, but the pressure of the holding setscrew, which was then directly upon top of the tool, caused the bushing to spring and bind the work. Thinking to help matters, I drilled a hole through the wall of the bushing for the setscrew to enter, but the hole proved to be only a lodging place for chips, which would wedge into it and again rough up the surface of the work.

My next move was to transfer the setscrew to the corner of the box-tool, where it is shown by the full lines of the sketch, and this proved to be the final solution. As the greater part of the pressure of the work upon the bushing was at the upper point of contact, I drilled the wall of the bushing for the setscrew in two places, as shown, before hardening it, and this allowed me to reverse its position in the box tool after the upper point of contact had become worn, and thus bring a fresh surface to bear upon the work, doubling the useful life of the bushing.

Sizes of Center Holes in Mandrels

By Charles F. Henry

There is considerable hit and miss when it comes to drilling and countersinking center holes in mandrels and similar pieces, although the combined center-drill and countersink has done much to improve the situation. The size to be used on a mandrel of given diameter is, however, generally left to the discretion of the man in the shop.



A Diam. of Mandrel	B Largest Diam. of Center	C Size of Drill	D Depth of Hole	A Diam. of Mandrel	B Largest Diam. of Center	C Size of Drill	D Depth of Hole
0.25	0.12	0.052 #56	0.15	1.75	0.59	0.238 #B	0.73
0.50	0.25	0.102-38	0.30	2.00	0.62	0.250-E	0.77
0.75	0.38	0.152-24	0.45	2.50	0.69	0.272-I	0.85
1.00	0.50	0.199-8	0.60	3.00	0.75	0.302-N	0.94
1.25	0.53	0.213-3	0.64	3.50	0.82	0.323-P	1.00
1.50	0.56	0.228-1	0.68	4.00	0.88	0.348-S	1.10

Sizes of center drills and countersinks

The accompanying table gives a few of the sizes of center drills and countersinks used by the Remington Arms Co., Ilion, N. Y., on its mandrels.

While the original table included sizes for mandrels varying by small increments, only a few are given here as a guide for average use.

Slings for Handling Finished Work

By William J. Fisher, Jr.

In our shop we handle a great many rolls, some of which are engraved and must be handled with care.

We found that in lifting the rolls by an ordinary rope sling, there was danger of injury to the surfaces by contact with various objects.

To overcome this danger we now make our slings of double leather-belting from 6 to 20 in. in width and pass the slings around the bodies of the rolls to protect them. The plies of the belting are opened at the ends and forgings made from steel plates inserted. The forgings are drawn down to a knife edge at the inner ends, while the outer ends have holes worked in them for the crane hook. The forgings are fastened in place with copper rivets having flat heads.

On some of the slings we glue a piece of canvas or felt to prevent any chance of injury to the work.

Plate for Setting Drills

By Francis C. Henry

The Olds Motor Works has a very ingenious method of setting drills for depth on multiple spindle machines. Instead of measuring each drill or having a special table to tell how each drill spindle should be positioned with regard to the others, it has a drill setting plate as shown herewith.

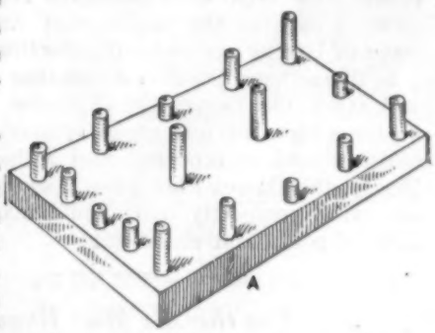


Plate for setting drills for depth

The whole device consists of a base plate *A* and as many posts as there are drills in the setup. These posts are located according to the piece to be drilled, and the length of each post varies inversely as the depth the hole is to be drilled.

With the drills in place the plate is placed on the table and the drill spindles set so that each drill touches the post beneath it. There is no measuring except to note that each drill and post are in contact.

The plate and posts are of aluminum so as to be light to handle and are, of course, not subjected to wear of any kind.

As a time saver and a preventer of mistakes, this device comes near being a prize winner.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Another Turning Point in History

THE acceptance of the Dawes Plan by the London Conference bids fair to mark a turning point in world history. With ratification accomplished by the legislative assemblies of France and Germany, there is every reason to believe that peace really exists and will be followed shortly by better times.

An editorial writer in a New York paper compared the Dawes Plan acceptance with the second battle of the Marne. At the first battle of the Marne the French armies and the British expeditionary force stopped the German steam roller and upset a plan that had been confidently expected to eliminate France as a world power. The United States was still a neutral and consequently took no part. At the second battle of the Marne, American troops were largely responsible for the turning of the tide.

The Versailles Treaty may fairly be compared with the first Marne battle because, although President Wilson sat at the council table, the result was essentially a product of European diplomacy. The Dawes Plan, on the contrary, is quite the reverse. It smacks more of sound American business policy than of politics. Hence the parallel drawn by the New York editor.

But there is a third comparison that may be made without too great a stretch of the imagination and that is in the field of foreign trade. The Versailles Treaty marked the beginning of a short period of frantic buying of American goods abroad. Other producers, particularly those in the equipment field, were unable to meet the demand and United States exports grew apace. When it was found that the Versailles Treaty did not produce the reparation payments from Germany which were to pay for the purchase of American goods, the wave of buying receded with startling rapidity.

It is our hope that the acceptance of the Dawes Plan will mark the beginning of a new period of foreign business for American manufacturers of machinery and tools. Based on economic fact rather than on political theory, the Dawes Plan gives a sounder foundation for universal prosperity and should mark the real beginning of peace and contentment.

Use the Air Mail Regularly!

THE coast to coast continuous air mail service has been in operation for nearly two months and has proved feasible and dependable. Mail is delivered between New York and San Francisco in less than 40 hours. Just what this means in the saving of time is not yet fully appreciated by business men in general.

The service is experimental insofar as its continuance depends on the patronage being sufficient to cover the cost. It is incredible that the business men of this country will fail to take advantage of this remarkable air service, the only one of its kind in the world, or that they underestimate its importance.

The continuance of this service will do much to stimulate the growth of commercial aviation. Unless such stimulation is forthcoming we are in danger of losing the few commercial airplane factories now in existence. For, without orders in sufficient quantities to make airplane building possible, no factory can keep its organization together. And the building of airplanes requires the employment of trained men who cannot be picked up promiscuously.

The Foreman Who Dared

UNDER the heading given above our old friend John R. Godfrey presents an argument for the use of modern machine equipment which is a bit unusual, but which has a thread of logic that might well be more carefully considered. Most managers quite naturally resent what seems like criticism or dictation. Foremen probably feel the same way about it, but when the job is of prime importance they swallow their pride and stay at work.

On the other hand the foreman who wants to be progressive cannot afford to stay in a shop with makeshift equipment. It isn't a question of money so much as it is the opportunity to become familiar with modern machines and methods. Foremen who have the ambition and the initiative to demand better machine equipment are good men to keep your eye on. The chances are that such men are worth keeping even if it does go against the grain to have positive requests for better equipment, as a sort of an ultimatum.

Foremen in any line who dare urge the use of the best machines may not make themselves wholly popular but if they can back up their continued requests for equipment by facts and figures as to increased production and lower costs, they are bound to win in the end. Builders of modern production machines will aid the foreman in getting the necessary information. And no foreman can do himself, his employer or the industry more lasting benefit than by quietly but constantly urging the abandonment of antiquated equipment and the purchase of the most modern machinery for the work in hand.

Where the management is entirely financial the foreman can do a real service in this way. And the management will do well to carefully consider the recommendation of foremen who are sufficiently interested in their work to be posted on the latest equipment.

Just Suppose

JUST SUPPOSE that some unusual individual got a law passed making it compulsory to scrap every machine used in business in the country on its tenth birthday. Not only machine tools but washing machines, ice cream freezers, sausage machines.

Seems like an awful waste you say—some machines don't begin to wear out in ten years! Of course they don't, but wouldn't it be better for everyone if they did? Isn't it more of a waste to keep them in the shop? Wouldn't the average owner of a ten-year-old boring mill be better off if some one chloroformed him and threw the machine on the scrap heap?

Of course, it may be a crazy notion, but,

Just suppose.

Shop Equipment News

Wallace No. 8 Power-Driven Bending Machine

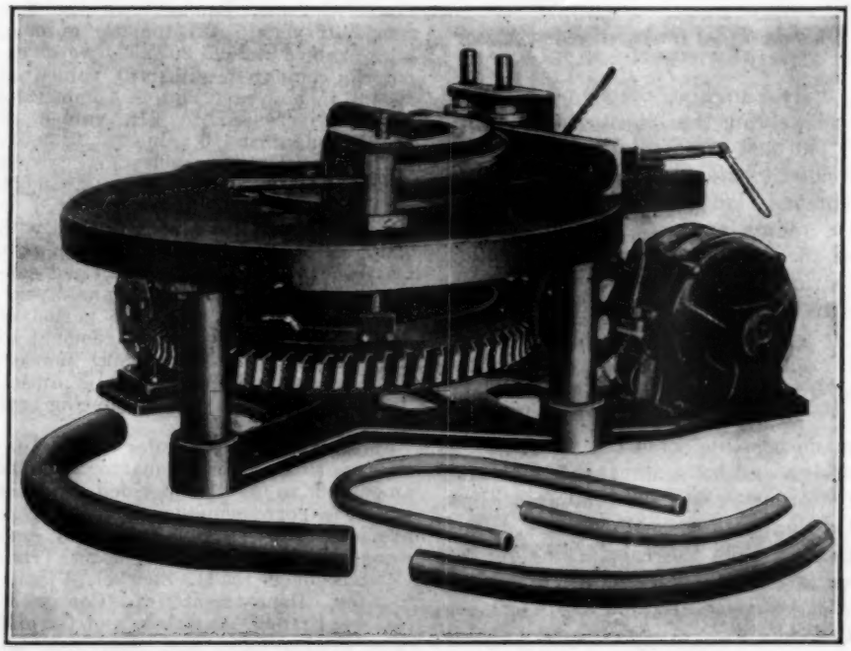
A recent addition to the line of bending machinery manufactured by the Wallace Supplies Manufacturing Co., 1310-12 Diversey Parkway, Chicago, Ill., is the No. 8 power-driven machine shown in the accompanying illustration. This machine has sufficient capacity to bend 4-in. pipe cold, and will also handle reinforcement bars, square and round bars, angles, channels and tees. A number of pieces of pipe, conduit and tubing that were bent cold are shown in the illustration.

The machine is shown equipped with a form for making a 90-deg. bend in 4-in. pipe, but the pipe can be bent through a greater angle, either by resetting the work in the form and repeating the operations, or by having the machine equipped with a special form to suit the angle of bend desired. The form is secured to the head of the machine and rotates with it as the machine is operated. One end of the pipe is clamped to the form by means of an eccentric lever that bears against a floating block shaped to fit the pipe. For a reverse bend the fulcrum pin that secures the eccentric to the clamp is removed to take out the finished bend. Special forms can be furnished for making bends of various angles with radii from 4 to 36 in., depending on the material.

Between the form and the back-pressure rollers, a floating follower bar is employed to support the walls of the pipe at the point of bending and thus prevent flattening. The back-pressure rollers are positioned on pins that are easily removable, and are mounted on a movable bracket in a tapered extension slide. They can be moved backward and forward through a distance of 24 in. to suit the particular tool equipment being used. A screw adjustment is provided for this setting and is so arranged that the entire screw mechanism can be positioned as desired on the slide.

A movable top block is attached to the main worm gear and serves as a knock-out for the clutch mechanism. This block can be set at any desired point on the flange of the gear and will cause the machine to stop automatically after turning through the angle required for the bend being made.

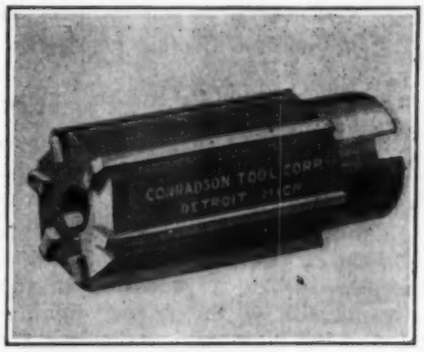
When bending a 2½-in. pipe and smaller the machine is operated through the regular worm gearing, but for larger work a set of back gears is provided. A lever on the machine operates the fingers of a double cone clutch mechanism through which the machine may be operated in either direction or stopped. The machine requires a floor space of 6½x6 ft. and weighs about 8,000 pounds.



Wallace No. 8 Power-Driven Bending Machine

Conradson Die-Cast Reamer

The Conradson Tool Corp., 2539 Woodward Ave., Detroit, Mich., has recently placed on the market a line of reamers in which high-speed



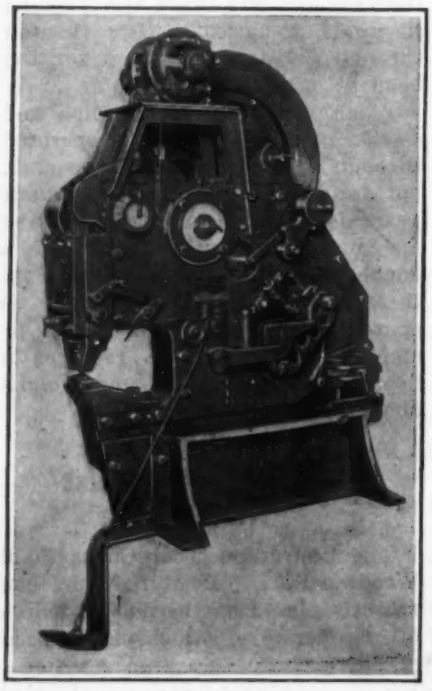
Conradson Die-Cast Reamer

blades are cast in place in the body. The melting-point of the alloy of which the body of the tool is constructed is much below the drawing-point of the blades, so that the cutting properties of the blades are not lost in the casting operation.

These reamers are manufactured in both shell and chucking types, and in a variety of sizes from 1 to 5 in. in diameter. The alloy used in the body of the tool is tough and hard and is said to have about the same physical properties as machine steel. The low cost of this reamer is due to the method of manufacture.

Buffalo Junior Universal Ironworker

A small model of its combined punching, shearing and bar cutting machine, has recently been placed on the market by the Buffalo Forge Co., 490 Broadway, Buffalo, N. Y. This unit has the same slitting, shearing, mitering and bar-cutting capacities as the larger No. 1 machine made by this company, but the framework is



Buffalo Junior Universal Ironworker

more compact and the mechanical design has been changed in some particulars. It is especially adapted for use in the small shop where floor space is somewhat limited.

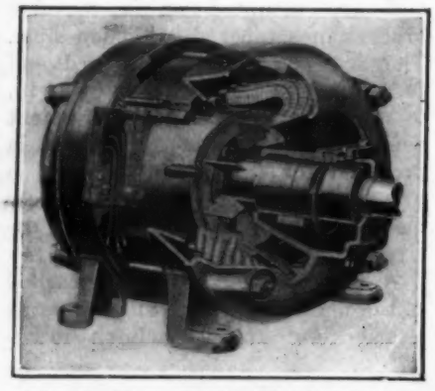
The main differences between this and the larger models are found in a shorter throat, a reduction in the over-all size of the frame, elimination of the high and low diebloek for punching girders and H-columns with the substitution of a combination dieblock for handling channels and beams, as well as angles, tees and flat work. The one-piece subbase of the larger machines is replaced by two bracket supports, necessitating the construction of a 14-in. concrete foundation in order to obtain a proper operating height of the machine.

The shorter throat limits the capacity for sheet work but makes possible the compact frame and small space requirements. The punch end of the ram is made of square tool steel and hardened. The rocker arm engages the rocker through a hardened tool-steel seat and the connecting rod has been dispensed with, the eccentric engaging directly with the walking beam on the punch end.

The design of the driving mechanism of the machine makes possible a rapid change from motor to pulley drive, without removing the drive shaft. The machine will punch I-beams and channels from 5 to 15 in. in size. The shears will accommodate plates up to ½ in. thick and the bar-cutter will shear rounds up to 1⅛ in. in diameter. Standard coping and 90-deg. notching tools and a triple punching attachment can be furnished with the machine.

Lincoln Type D Arc-Welded Motor

A series of electric motors, in the manufacture of which the operation of arc-welding plays an important part, is now being marketed by the Lincoln Electric Co., Coit Rd. and Kirby Ave., Chicago, Ill. The end frames are made by rolling a stand-



Lincoln Type D Arc-Welded Motor

ard steel angle in the shape of a ring and welding the ends together.

The feet are drop forgings and are welded to the angle-steel end frames. The fan blades for the ventilation of the motor are welded to the motor, as shown in the accompanying illustration. Finally, the copper rods or windings of the rotor are welded to the short-circuiting rings, preventing any loosening or current leakage at this point.

The arc-welding methods have made possible some improvements in design and have decreased the manufacturing costs of the machines. One advantage is that the frame is thinner than the cast frame for the same motor and provides more ventilating space between the frame and the coils.

The end frames can be hot-riveted together and drawn up very tightly without danger of breakage. In this way the stator laminations are held securely and produce a good field.

Heald Semi-Automatic Internal Grinding Machine

The Heald Machine Co., Worcester, Mass., announces that it will introduce at the New Haven machine tool exhibit, a semi-automatic model of its hydraulically-operated internal grinding machine. In the operation of this machine the operator simply unloads and reloads the chuck, and then trips a starting lever. The table then moves forward to bring the grinding wheel into action and traverses the work under roughing feed until the finished diameter of the work is approached. The feed is then automatically reduced to 0.0001 in. per stroke and the traversing movement is continued until the grinding is completed. The table then returns to its starting position and the machine stops. An illustrated description of this machine will appear in a later issue of the *American Machinist*.

England Exporting Many Automobiles

Large increases in British exports were recorded during the first six months of 1924, as compared with the same period of 1923, according to report to the Department of Commerce from Alfred Nutting, clerk to the Consul-General, London. In the current half year, 4,421 touring automobiles valued at £1,209,257 were exported, compared with 940 valued at £394,215 a year ago. Commercial vehicles increased to 616 valued at £365,912, against 410 valued at £339,017 in 1923. In motor cycles and tricars the increase was also striking, 20,059 valued at £881,118 being exported in the first half of 1924, as compared with 7,399 valued at £383,537 a year ago. On the contrary, imports declined considerably during the current half year, as compared with the same period of 1923. However, with the removal of the McKenna duties, a very marked increase in British imports is anticipated, especially in the touring car class.

Imports of automobiles into Hungary during the first quarter of 1924 amounted to 304, a decided increase over the corresponding period of the previous year in which only 47 cars were entered, reports Assistant Trade Commissioner E. M. Zwickel, Vienna, to the Department of Commerce. Italian, French, Austrian, and German cars predominate, and American imports rank fifth in importance.

News of the Week

Industrial Mobilization Practice Is Held in New York

Preparing for capacity production in war emergencies

Judge Elbert H. Gary, chairman of the United States Steel Corp., began the mobilization of the industrial resources of the New York district Sept. 4 to meet a theoretical war emergency. As Chairman of the Industrial Advisory Board, working with the Ordnance Department of the Army Reserve Corps, he gave all the instructions that were necessary to prepare industry to the requirements of the national defense only short of the actual manufacture of munitions.

THE COMMITTEE

The committee of which Judge Gary is chairman includes P. E. Crowley, president of the New York Central Lines; John I. Downey, president of John I. Downey, Inc.; M. Friedsam, president of B. Altman & Co.; S. Parker Gilbert Jr. of Cravath, Henderson & DeGersdorff; James G. Harbord, president of the Radio Corp. of America; Herbert P. Howell, vice-president of Peirls, Buhler & Co., Inc.; Samuel McRoberts, president of the Metropolitan Trust Co.; Charles M. Schwab, chairman of the Bethlehem Steel Corp.; Guy E. Tripp, chairman of the Westinghouse Electric & Manufacturing Co.; William H. Woodin, president of the American Car & Foundry Co.

Judge Gary explained that the meeting was one of the first steps in a week's program intended to determine how well New York was prepared to assume its share of the gigantic industrial burden that a war would incur.

"We realize that we still have a very great task before us, one that might seem well-nigh impossible but for the fact that so much has already been accomplished as to indicate the probability of complete success within the next four or five years," he said.

WILL MEET ON DEFENSE DAY

"We have learned just how far the work has progressed in the New York district and what pressing problems the Advisory Board could be of assistance in solving if the assumed emergency really existed. We adjourned to meet again on Sept. 12, 1924.

"The industrial effort we face in the event of invasion will require one out of every four wage-earners in the metropolitan area to forsake his regular employment and to turn his hand to new and unfamiliar tasks in the manufacture and inspection of non-commercial implements of ordnance and aerial equipment. We have with us yet a fair nucleus of the ordnance knowledge salvaged from the World War and our first problem is to disseminate this knowledge effectively."

The idea of putting the industrial forces of the country on a preparedness basis does not entail actual production of munitions. The plan is to have dies and other implements of manufacturing, as well as specifications and formulae, ready for immediate distribution among industrial plants. Each plant will know beforehand what it will be required to do.

Industry will be speeded up to peak production within approximately half the time required in the World War. And furthermore, the War Department will not have to carry huge stocks of war supplies when industry is ready to start immediate production upon telegraphic notification. This means closer co-operation with the government.

By these practices it is expected that not only will industry be ready at a moment's notice, but that great expense and waste will be eliminated and that the government will be able to conserve its resources to much better advantage. With industry and defense forces both held in readiness, it is asserted that the delays and embarrassments with which this country was confronted in the last war will be overcome and that emergency will not find us unprepared.

Further demonstrations of what manufacturers can do will be staged on Defense Day, Sept. 12, and plans that are now in the making will be perfected and will be tried out, not only in the New York district but in other parts of the country.

Germany's Response to the Dawes Plan Outlined and Discussed

How United States will fare under Europe's economic recovery

The following excerpts relating to the Dawes Reparations Plan and its probable affect on business in the United States as well as in Europe are from the monthly bulletin for September that is published by the National City Bank, New York City:

It would be too much to say that provision has been made against all possible disagreements, and that everybody is going to be satisfied with the results of the Dawes plan. The plan is largely experimental, a scheme for an undertaking the like of which never was attempted before, but it has been before the world for more than four months, and nobody has been able to find any serious fault with it. The most common criticism of the plan has been on account of its not determining how long the payments should continue or what the aggregate should be, but the conference itself has not dealt with these matters.

A NOVEL UNDERTAKING

The plan is a great experiment. There is no precedent for the payment of sums of this magnitude where the payments run one way and no offsets are available. These payments are outside of trade, which has a natural tendency to settle itself. Over and above its regular foreign trade settlements, Germany must export goods or services to cover the obligations.

Considering first the ability of Germany to pay, it is evident that this will depend upon high production by the German industries coupled with low consumption by the German people, thus enabling a great industrial product to be exported. Following the analysis farther, it probably means long hours in the industries, or at least the working day which will yield the largest product. The late Hugo Stinnes insisted that Germany must go back to the 10-hour day in order to pay reparations. The 10-hour day was the rule in Germany before the war, and the country had no excess of merchandise exports over imports then. Its problem now is to create a very large excess, hence it must produce more and consume less. In order to produce more and begin at once, longer hours would seem to be the only sure resort. Invention and improved methods are the best way of increasing production, but their results are incalculable, and anyway take time. Moreover, they require capital accumulations, which will be difficult to make in Germany. But besides increasing production it will be necessary to reduce consumption, or at least prevent consumption from increasing to correspond with production, for it is a surplus of production and of exports that is required. In order to hold down consumption it will be necessary that wages shall be low as compared with the cost of living, which may be accomplished either by means of low money-wages or by taxation which raises the prices of everything the people have to buy. Taxation is the method by which the government takes over the share of production which must go for reparations.

Briefly stated, these are the conditions which must be imposed in order to create a large surplus of exports over imports. Economists describe them very simply, but can they be put into effect as easily as they are described?

In case Germany demonstrates her ability to create a surplus of exports over imports sufficient to meet the reparation payments, what will be the attitude of other countries toward such a volume of German exports and what the effect upon business elsewhere? Economists whose opinions are entitled to respect are able to dispose of the difficulties which some people apprehend, as easily as they show how Germany can create her surplus of exports. Arranged by them on paper there does not seem to be any problem. And yet in the countries adjoining Germany, particularly among business men producing the same kind of commodities which must constitute the chief exports of Germany, no little concern is manifested. Evidently the British industries are apprehensive of severe competition, for the British Prime Minister has announced that he will appoint advisory committees representing the principal industries, to confer with the government.

The reason for this apprehension is that the principal industries of Germany are of the same character as the principal industries of Great Britain, and this is true of other countries as well. Germany's increased exports must be of products like the products of other countries. How many such products can the market take? It is an economic truism that there is no possibility of over-production, provided production is well-balanced. It is all a matter of balanced demands and offsetting exchanges. If it were possible to increase all kinds of production simultaneously, the aggregate might be doubled, provided all kinds came on the market in the right proportions, and there would be no disorder; the world would simply move up to a higher standard of living. If this is what Germany's increased exports will mean, there is nothing to fear from them; but will the supply of all kinds of goods and services increase in the right proportions and be absorbed without disturbances? This is what business men are not sure about.

World Wide Prosperity

On the other hand, it is true that the credits created around the world by the surplus of German exports will be turned over to the allied countries, constituting the reparation payments. They will constitute purchasing power to be used by the allied countries instead of by the German people. Why then should there be any more disturbance than if there were no reparation payments?

The whole question turns upon the degree of abnormality in the situation. It is the abnormal developments that disturb the industrial balance. Are the offerings of the principal German industries—iron, steel, machinery and the textiles—going to be greatly in excess of their offerings in the past, and if so what will be the effect upon those particular industries in other countries, and what will other countries do about it? Also, what will the purchasing power created by these reparations payments be used for, and to what extent will such purchases provide employment for workmen who might be thrown out of employment in other industries? Workmen do not change employments readily, but prosperity in one industry tends to make employment in other industries that are allied or dependent upon it.

It is also to be considered in this connection that Germany may require considerable time to get in full productivity. While her industries are understood to be generally equipped for a larger production than ever before, the country is financially weak. There is a great shortage of working capital, as prevailing interest rates show. The industries cannot run full without more working capital than the country possesses. It will take a long time to accumulate what is required, and immediate relief must come by attracting foreign capital with high rates of interest and by inducements to invest in the industries.

Effect on the Industries of United States

So far as the United States is concerned, it seems probable that the revival of Germany will have a direct effect in increasing that country's demands upon us for such raw materials as cotton and copper and probably for meats.

In one of the lines in which Germany is proficient, however, the manufacture of electrical equipment, the world demand is likely to be large enough to keep the capacity of all countries fully employed for years to come.

In the long run, however, and when the readjustments required to restore the world's equilibrium have been made, the recovery of Germany unquestionably will be generally beneficial. Whatever disturbance there may be will result from the fact that new and strange conditions are created, and that readjustments are necessary. The tendency always is back to normal.

Evasion of Duty on Tungsten

An evasion of the duty on tungsten is assuming significant proportions and has resulted in a protest from the importers who must pay the full duty when tungsten is imported in the regular manner. The payment of the tungsten is avoided by importing tool steel scrap. The high tungsten content of that type of steel then is recovered. Scrap steel pays a duty of 75 cents a ton. The duty on tungsten is 72 cents per pound.

Officers of the customs division of the Treasury Department realize that this constitutes a loop-hole in the act, but the law makes no provision for meeting the situation. It happens that this loop-hole was foreseen and a draft of a paragraph which would have closed it was submitted to Congress when the tungsten duty was under consideration. The committee, however, failed to include it in the bill which was later reported and passed.

August Auto Output Is Improved

Continued conservative improvement in the automobile business is indicated in the August output of 268,477 cars and trucks, the total estimated from shipping reports submitted at the directors meeting of the National Automobile Chamber of Commerce.

The figure is two per cent above July which in turn exceeded June by six and one-half per cent.

The rate of production is twenty-two per cent under a year ago which is regarded by leaders in the industry as not unexpected since the output in the early months of the year was much higher than in 1923. Stocks in dealers hands are well liquidated, and present manufacture is based on orders from the field.

Motor manufacturers believe that the gain in the automobile trade is a reflection of generally improved industrial and farming conditions.

Dealers report that the fall outlook is excellent, with expectation of sales much better than this summer and with farm trade exceeding last year.

Light truck market prospects are better than last fall in Chicago, Cleveland, Pittsburgh and other large cities, with heavy duty vehicles promising business equal to a year ago.

Closed car demand is increasing, and sport models except in a few popular lines are less in demand.

The Franklin Institute Centenary

Elaborate preparations are being made for the centenary celebration of the founding of the Franklin Institute and the inauguration of the Bartol Research Foundation which will be held in Philadelphia Sept. 17, 18 and 19. Most of the sessions will be held at the Franklin Institute Hall, 15 S. Seventh St., while the Walnut Street Theater, the Bellevue-Stratford Hotel, and other prominent places also will be used.

An imposing program of speakers has been arranged and men well known to the engineering profession are scheduled to talk on various interesting subjects. Elihu Thompson is chairman of the honorary committee, and Gellert Alleman is the chairman of the executive committee.

Civil Service Examinations

The Government announces three examinations under the Civil Service to be held in the near future. One is for the position of assistant structural engineer with a salary of $3,000 and will be held Sept. 17 at various points in the United States. Three other positions are embraced in the examination for metallurgist, associate metallurgist and assistant metallurgist, paying salaries of $3,800, $3,000, and $2,400 respectively. Applications of these three positions close Sept. 30.

The position of associate highway engineer with a salary of $3,000 will also be filled by examinations. Applications for this examination will close Sept. 30.

France Prepares for Further Prosperity

Most industries busy with workmen imported from Africa and Poland—Increase shown on year's business and future brighter than before the war—Citröen's new plan

By Our French Correspondent

PARTISAN politics appear to have developed a situation in France which is manifestly one of unrest. As a result of the Conference of London the French are fearful as to the competition which the revival in Germany may bring forth and in a vague way are already proposing a working arrangement with Germany based on their respective units of merchandise exchange. England on her part views this with apparent disfavor as affecting her world trade. The situation has been improved undoubtedly, but beyond the general outlines of what may actually come into practice the situation still remains cloudy. Meantime France is making what progress she may and at all events is assured of her Alsace-Lorraine metallurgic products entering Germany free of duty.

Most metallurgical products are advancing in price and aluminum has increased in the last six months from 800 francs for 100 kilos to 950 francs. The railways are increasing their rolling stock and motive power, and there is a rumor that the French lines are already in pourparlers with German makers of rolling stock for their most pressing needs, with the result that the claim is made that this very operation of itself will affect 150,000 French workmen. Probably this is so but as there are still few unemployed in France in any industry this is probably another political rag flung to the breeze.

Foreign labor is still rushing in to France. Paris alone in her heavy industries, of which the metal trades form the bulk, is giving employment to something like twenty thousand North African Arabs and Berbers and the coal mines of the Northern departments in the last three months are said to have imported forty thousand Polish miners.

Labor Shortage

According to a statement of Monsieur Justin Godart, Minister of Labor, "the necessities of the moment, above all the crisis of natality of the last two or three decades, oblige France to look for labor from abroad to supply the home deficiency." There seems no denying the strength of such a statement from such a source. As he further said that it was solely through the development and application of electric power that France would otherwise be able to hold her own, the future industrial operations are seemingly clearly marked out.

During the first seven months imports of raw materials for industries in 1924 show an increase over those of 1923 of 4,191,291,000 francs and those of fabricated objects, 486,325,000 francs. Exports likewise show notable increases, the first of 1,197,425,000 francs and the second of 5,844,154,000 francs. Taking the latter item in the two respective classes of imports and exports as a base the showing is even remarkable.

There is a notable activity in the production of electric steel in the hydro-electrified districts of Dauphiny and Savoy and the plants are in full production with orders in hand for several months, the same condition applying to ferro-alliages and aluminum. Foundries and the transforming industries are also favored in a like manner, though prices are low as compared with production costs which are still rising in many co-related lines. As a master founder of the Grenoble distric has stated the crisis of the moment is one of a lack of capital and of labor as well. It is also claimed throughout the industrial regions of France where electric power is made use of that there is a shortage of the commodity and an abnormally disproportionate price compared with that which industry ought properly to support. Obviously this affects many of the smaller machinery trades.

French After Export Trade

France is at last paying strict attention to the marketing of her machinery products abroad through the efforts of commercial agents of consulates and embassies, taking a leaf from the book of experience of Germany before and since the war. Obviously it is the stimulus of German and British competition which has brought this about. Above all is a push being made on woodworking machinery and small metal working tools, band saws and files and other abrasive machines.

The firearm industry of France is and ever has been, important. It is evidently on the upward trend in that the government is being urged to modify its régime of taxes on sporting firearms and accessories. The Saint Etienne district in mid-France has virtually a monopoly of the manufacture and is important and powerful enough to have weight with the parliament of law makers and the finance administration to the end of getting that recognition, if not subvention, veiled or otherwise, which is often readily granted other industries. A permit to own a sporting gun in France costs 116 francs which is deemed as just so much added to the price of the article in the trade. This is probably not true, but it is a talking point and is bound to carry weight. Again there is the export trade which is said to be growing rapidly in this line, which is no longer considered a de luxe article, but one of necessity—again a talking point, and aid is being looked for in that direction as well.

The automobile trade is momentarily dull. The most important item of remark appears to be the fact that the Citröen company is increasing its capital to 50,000,000 francs, of which Monsieur Citröen is to receive shares to the value of 30 million for what he is bringing into the new company.

The president of the Mechanics, Boiler Makers and Founders of France makes the general statement to the effect that the political events of the past few weeks are bound to bring about a series of redoubtable problems in view of the future France-German relation. This statement, from such a source, is significant and if it means anything it means that the small manufacturer will find hard going ahead, with a tendency more and more toward combinations and consortiums, concerning which there are no laws in France which are directly derogatory.

The *Federation de la Mecanique et de la Normalization en France* (Standardization Federation) is in close working co-operation with the *Union des Syndicats de l'Electricite* for the formalizing of 30 separate headings of standardization in their co-related industries. These cover steel in the raw, aluminum, vocabulary of electro-mechanical items, copper, etc. The list contains also bolts and nuts, tool steels, standardizing of round, square and hexagon rods and bars, wire and cable, screw eyes, and springs of all forms. Added thereto will be a "normalized" list of tolerances which will be applied in all mechanical productions as well as a re-defining of units of measure. The result will be the elimination of many shapes, sizes and specifications of tools and machinery.

A new technical school is to be founded in Paris which will form workmen for the copper and bronze trades in so far as such manipulations are used in the furniture, decorating and building hardware and electrical industries. The course will cover a full calendar year and the student will enter the trade upon receiving his diploma as a full-fledged workman—founder, carver, lathe expert or designer, according to his tastes and aptitudes.

Northern Pacific Ry. Insures Its Men

One of the biggest life insurance policies on record was announced recently by the Aetna Life Insurance Co. —a $50,000,000 group contract for employees of the Northern Pacific Ry.

Every employee who has completed a probationary term of service is insured for an amount payable at death, and the insurance is paid for entirely by the railway.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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BEING in Chicago last week it was my good fortune to meet many prominent business men of that city. They were all hopeful of an active business during the autumn and winter, but the head of one of the largest jobbing concerns in the country said that the much talked of improvement was as yet "atmospheric rather than tangible." In this view most others in the same line concurred, but when I asked how they explained the increase over last year's bank clearings that has been reported for so many weeks they admitted that business must be good in some quarters with which they were not so well acquainted.

And this seems to be the truth. The ease of money and the readiness with which solvent corporations can sell their bonds has made it possible to undertake much new or auxiliary construction that would not have been entered upon otherwise.

Thus the U. S. Steel Corp. is spending $5,000,000 a month to increase its capacity. The Western Electric Co. has contracted to supply Greece with telephones that will have to be made in the United States. The International Telephone & Telegraph Co. has entered into a similar contract with Spain, and the equipment required will be manufactured in this country. A New York concern has contracted for a large building in Turkey and a Chicago firm is erecting blast furnaces with 160,000 tons capacity in Holland. The steel required for this work will be fabricated here. Another Chicago company is building grain elevators in Bulgaria. The machinery required will be shipped from the United States. Italy is improving her harbors and a single New York company has a contract for $10,000,000 worth of work at Naples.

The Pan American Co. is building 140 miles of pipe line. The Illinois Central R.R. is beginning a program of construction that contemplates the expenditure of $100,000,000. The Pennsylvania R.R. is to tear down the Broad Street Station in Philadelphia and replace it with one that will be larger than its New York terminal. It has also ordered 10,000 new all steel box cars that will cost $30,000,000, and the railroads that the Van Sweringens are putting together have placed an order for $28,000,000 worth of equipment.

The foregoing is but a partial list of the many large expenditures that have been made possible by easy money and are expected to keep the hands of labor busy and the wheels of industry turning. That they will have this effect at least in some directions there can be but little doubt.

Therefore it is not surprising to learn that the steel mills will soon be operating at 75 per cent of their capacity; that copper and the other nonferrous metals are again tending upward; that the demand for cement continues large and that the lumber business in both the East and West is quite cheerful. To count upon a continuance of these conditions through the winter seems reasonable and as corollaries higher prices for both coal and oil are to be expected.

But when we get into the field where the buying ability or disposition of the individual is a factor the outlook is not quite so clear. The farmers are or will be in a position to spend rather more than previously, but they have many debts to pay and the 75 per cent of the people who are not farmers will find their ability to buy clothing and household furniture cramped by the advance in the cost of the food that they must have or starve.

This may explain why some dry goods merchants are still dubious and it also sheds some light on the embarrassment of the Consolidated Textile Co. and the action of the American Woolen Co. in passing the dividend on its common stock because of the "severe depression in the textile business."

This brief analysis indicates continued activity in development work and new construction as long as money can be borrowed cheaply by big business, but it also indicates a restricted demand for non-essentials and luxuries as long as food continues high.

To this it should be added that an advance in interest rates would adversely affect all markets and that it may come if anything occurs to disturb political confidence or we commence to export gold in quantity.

As to the political outlook it can only be said that in the West LaFollette and Wheeler seem to be making the most of Republican complacency and Democratic apathy. The result is that some are again apprehensive lest the election will be thrown into the House of Representatives. The election in Maine next Monday is therefore awaited with unusual interest.

In detail the American markets need but little exposition. Bonds continue firm, but the stock market has lacked uniformity. As a class the railroad shares have been in demand upon consolidation talk, but the passage of the American Woolen dividend led to some selling of the industrials.

The securities of so many different corporations are now traded in on the Stock Exchange and the Curb that it is almost impossible to generalize concerning the trend of the market.

What's Doing in Industry

August did not prove to be any better than July in the machinery and machine tool fields, but there were bright spots during the past week that should be encouraging. The Chesapeake & Ohio Ry. has placed orders for over a thousand freight cars and other railroads signified their intention of buying equipment. Automobile production for August showed a slight gain over that of July and June and further increases in output are promised by motor car manufacturers. Truck and bus makers report exceptional business and are buying tools continuously. Steel and pig iron are both moving better than a month ago and here, too, further increases are anticipated. Unless indications fail, September and October should prove to be good months in all sections.

The acceptance of the Dawes plan is generally hailed as a move in the right direction, although no direct results will be forthcoming in this country for some months. Raw material sales should be increased, while competition in finished products will probably be a little keener for exporters.

Wall Street was irregular and closed weaker than it opened last week. The passing of the American Woolen dividend had a bearish effect on nearly all issues and only the strong withstood the attack.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Indianapolis

Considerably more optimism is to be seen in the tool and machinery trade here than a month ago. The demand for tools is increasing steadily, most of the demand coming from the automobile and allied industries. Virtually every automobile plant in this city has increased its production schedule and in one instance business is reported better now than at any time since immediately following the war. The body plants here also are working almost to capacity and the accessory manufacturers are buying much more actively than for many months past. The tool demand from railroads and interurban shops has dropped off somewhat, but following the grain movement it is expected more repair work will be done in preparation for the winter season.

A good demand has developed during the last two weeks from the coal mines in the western Indiana field. The demand from this industry not only is for tools, but also for special mining machinery. Many mines that have been down entirely for nine months have begun production again. Officials of the Nordyke & Marmon Co., which makes flour milling machinery, say the increase in milling with the rise in wheat prices has resulted in a large number of inquiries which will lead to some good business before winter.

Call for specialized machinery for use in the furniture factories has begun. Officials of these factories say business is much better than was expected for fall and a considerable volume of machinery either will have to be replaced entirely or extensively repaired. The independent car shops of the state seem to be better provided with business than the railroad shops themselves.

Canada

A persistent tone of optimism continues to pervade the metal markets of Canada with dealers everywhere expressing full confidence in the outlook for fall trade. The industry throughout the country reflects steadiness, while in some parts, especially in Montreal, an upward trend is quite apparent. Sentiment regarding business generally is more cheerful, especially in the Western provinces, but actual changes during the past couple of weeks have not been remarkable.

The outlook for basic metals is somewhat better. Implement dealers anticipate a good selling season ahead, with farmers particularly susceptible just now to selling arguments. Dealers in iron and metal scrap feel that the slight decrease in sales reported recently is merely a "lull before the storm" and that the advance in prices they have been predicting for some little time, is now not more than a week away.

Not so favorable is the situation in the steel industries. The production of 45,480 tons of pig iron in July marked a new low level for the year. The total tonnage to date, however, is above the figures for 1921. Foundry iron was nearly 50 per cent below the June total, and malleable iron was 79 per cent below. Basic iron production, however, showed a substantial improvement. The bar mill of the British Empire Steel Corp. at Sydney has recommenced operations and the rod, wire and nail mills will resume activity almost immediately. The rolling mills of the Canadian Car & Foundry Co. at Amherst, N. S., are employed on an order of 300 tons of reinforcing rods to be used for construction work at Montreal. This is the first time the plant has done work of this kind.

That the automobile industry is recovering from the set-back experienced during the late spring and early summer months is evidenced by the fact that the month of July showed a gain in production over June, this being a reversal of last year's trend when the month of July showed a perceptible dropping off of production.

Milwaukee

Sales of metalworking equipment are making some headway on a stiff upgrade, but no momentum has as yet been given the movement. The most encouraging feature of the situation during the early part of September was a slight gain in the number employed in foundries and machine shops in this district. This was indicative of improving orders, these coming largely as the result of the broadening of automobile operations generally.

Conditions in the machinery field generally are not yet what might be described as satisfactory. Makers of machine tools find orders rather scarce in number, and small in individual size. Users are still buying against the barest necessities, reflecting the quiet tone of their business. Here and there specialty plants are making some enlargement of their capacity, but they are exceptions, for the average shop finds itself with adequate productive facilities to handle all the business coming without straining equipment or buildings.

While metalworking tools are moving in a little better way, there has been some decline in the call for woodworking machinery, which is an important part of the general machinery industry in Milwaukee and Wisconsin. The letdown in building operations, while not yet pronounced, seems to be anticipated by the lumber industry judging by the declining production schedules and the falling off in the purchasing of new machinery for sawmills, planing mills, flooring factories, sash and door plants and all along the line. The situation is not yet such that woodworking machinery manufacturers or dealers are expressing concern, but they do not all look for a continuance of the strong call for their products as that which has existed over a period of several years.

The agricultural machinery field grows more promising, but the improvement has not yet reached the stage where manufacturers are compelled to do more than replace obsolete and wornout tools. Conditions in this industry have so strained financial ability in the last four years that there is no buying power, particularly when the need to buy is not pressing.

The tool industry looks for continued betterment, with few developments.

Southern District

August machine tool and equipment sales among the Atlanta distributors and those in other larger cities of the South showed a satisfactory improvement over the corresponding month of 1923, averaging apparently about 10 per cent, but varying considerably among the different dealers. Some reported an improvement of only 4 or 5 per cent, while a few as much as 12 to 15 per cent, the latter increases being generally noted among larger dealers covering the whole of the Southeast. Compared with July, sales in August also showed an improvement, and were quite a bit better than they were in June, running, in fact, about on a par with the good business that was being experienced earlier in the year.

Favorable agricultural conditions throughout the district, with general industrial conditions good, give promise of a satisfactory fall business, many of the larger dealers looking for September and October business to continue better than last year at this time, and also a little better than the midsummer period.

Railroads still are buying heavier equipment on a fairly good basis, but not as much as earlier in the year. It is now practically certain that 1924 sales to railroads will be the largest they have ever been in the history of the industry in the South, as the shop construction program of Southern roads this year has also exceeded any previous annual period.

Sales to smaller shops and service

stations principally of late have been used and rebuilt equipment, comparatively little new equipment being purchased by these industries. Used and rebuilt sales, therefore, are also running somewhat better than last year, but to service stations are not as large as two or three months ago.

Sales of road building equipment have fallen off due to the lateness of the year, but with state legislatures in the Southern states having passed road building measures this summer calling for heavy expenditures next year, the outlook is very good for another excellent season next spring and early summer. This year road building machinery sales were the best they had been in the South in a number of years.

New York

More inquiries were received by the machine tool dealers in the New York district during the month of August than during the month of July, but the amount of actual sales did not improve and in some cases they are reported as less, although it is believed that the general average would be about the same. On the strength of the inquiries and the fact that the summer quiet months are over, it is expected that September and October will make a better showing.

Railroads are the only ones actively in the market and this source is not buying on any exceptionally large lists. The Lehigh Valley, the C. & O., the New York Central, and the Southern Pacific all purchased needed tools in the Eastern section of the country this week. Motor truck and bus builders were also buyers to a limited degree and there were inquiries received from the big electric companies.

Japanese buying stopped almost as suddenly as it started but dealers are inclined to believe that another list will be forthcoming shortly and that machine tool builders will make some good direct sales.

A close watch is being kept on Europe and the effect of the Dawes plan on the machine tool exporting. It is not expected that any change will be forthcoming within the next few months.

Used tools are selling well, although there has been a let-up in this business as well as in the new tool market.

Detroit

A period of "watchful waiting" has begun for machine tool and machinery representatives in the Detroit territory, a circumstance dictated by the close relation between the machinery and automotive industries.

The present tendency is to wait for the auto business to get itself reestablished to an extent where the future may be predicted with some degree of certainty. Just now sales in the machine tool field are scattered.

With the majority of the new models announced and accounted for, Detroit motor car plants are on a more sound and certain footing than they were earlier this summer. Although few production records will be smashed this fall, auto factories here are looking forward to a steady conservative output that will measurably exceed the summer performance, though not nearly approaching the high mark set early in the spring. Several of the smaller factories which have been partially closed for extended periods are back on full time. Many of the larger ones—notably Dodge and Hudson—are running near capacity.

Hudson's showing this year has been by far the best of the larger plants. The company is the first six-cylinder manufacturer to reach the six figure mark in production for the year, the factory having turned out its 100,000th car made this year recently. This feat may be compared with a total production of Hudson and Essex cars during 1923 of 83,118.

Much importance was attached to the interview authorized this week by Henry Ford in which he said that his own industries will continue running with full forces all winter.

Business Is Better in Bridgeport

The feeling among manufacturers in Bridgeport, Conn., and vicinity is that the "corner has been turned" and "business is looking up." The Jenkins Bros. Valve Co., expects shortly to increase its working schedule from 40 to 48 hours weekly in the brass valve department and by Jan. 1, the working force in the iron valve department will be increased by the addition of 100 workmen.

The American Chain Co., finds improved business in the central West and New England for the general line and a "decided upturn" in the country as a whole.

The American Tube & Stamping Co., reports a better turn in the last four weeks and anticipates a continuance of this.

The Forsberg Manufacturing Co., has purchased factory buildings, formerly part of the Lake Torpedo Boat Co., and plans expansion. The company makes hardware and saw frames and plans additions to its building hardware specialties line.

Business Items

The C. G. Spring & Bumper Co., Cleveland, will move Sept. 15 to the building located at 830 E. 70th St., formerly occupied by the King Bridge Company.

The Cleveland office and warehouse of the Motch & Merryweather Co. will occupy one portion of the former King Bridge Co. buildings after Sept. 15.

The Chemical & Vacuum Machinery Co., Inc., Buffalo, N. Y., has been incorporated to acquire the patents and all development of the Research Plant established by E. G. Rippel and his associate, Chas. O. Lavett. The directors elected are: J. F. Schoellkopf, Jr., William Schoellkopf, John Casa Eguia, Chas. O. Lavett and E. G. Rippel. The officers elected are E. G. Rippel, president; John Casa Eguia, vice-president; William Schoellkopf, secretary-treasurer; and Chas. O. Lavett, manager.

Obituaries

WILLARD C. LIPE, one of the founders of the gear manufacturing industry and until recently vice-president of the Brown-Lipe Gear Co., Syracuse, N. Y., died recently in Tacoma Park Sanitarium near Washington, D. C. He was 63 years old and had been in ill health for two years. Under the direction of Mr. Lipe and his brother Charles, who died in 1895, the gear making industry developed in the latter years of the nineteenth century to a point where it now ranks as one of the leading industries of Syracuse.

Personals

J. W. BLACKFORD, formerly manager of sales for the Dale Machinery Co., in New York, and also formerly assistant to the president of the Consolidated Machine Tool Corp. of America, will be manager of sales of the Dayton swaging machine and the Torrington ball bearings for the Torrington Co., Torrington, Conn.

S. T. MASSEY, assistant general manager of the Heald Machine Co., Worcester, Mass., is in England and Continental Europe on a business trip, visiting Heald agencies and establishing new ones.

JESSE H. NEAL, executive secretary of the Associated Business Papers, of which the *American Machinist* is a member, was decorated with the Legion of Honor at a banquet tendered him at the Hotel Continental, Paris, on July 28. Mr. Neal, who was accompanying the advertising club on its visit to Europe, was presented with the decoration for excellence of work with the business papers. M. Chautemps, Minister of the Interior, made the presentation and appointed Mr. Neal a chevalier of the Legion of Honor.

D. K. RIVAS has been appointed manager of the New York office of the Wagner Electric Corp., St. Louis, Mo. His headquarters will be 50 Church St.

JOHN GAILLARD, formerly of Frank B. Gilbreth, Inc., has joined the staff of the American Engineering Standards Committee as engineer-translator. Before coming to America Mr. Gaillard was acting director of the Central Normalisatie Bureau at Delft (Holland), which is the secretariat of the national industrial standardizing body of Holland.

J. F. WHALEN, formerly with Manning, Maxwell & Moore, New York, in the Philadelphia office, has opened an office in the Bourse Building, Philadelphia, as the Whalen Machinery Co.

C. J. ELLISON, for two and a half years assistant manager of the Reo Motor Car Co., Windsor, Ontario, has been appointed manager of the plant.

F. C. MCMATH, director of the Canadian Bridge Co., Ltd., Walkerville, Ont., has recently been elected a

member of the American Society of Civil Engineers.

E. T. SPIDY, assistant superintendent of the Dominion Engineering Works, Lachine, Quebec, has been forced by ill-health to return to New Zealand. During his fifteen years residence in Canada Mr. Spidy gave much of his time to the study of the many aspects of waste in the metal-working field.

E. G. RIPPEL, for many years associated with the Buffalo Foundry & Machine Co., having organized that company originally in 1901, has recently become connected with the Chemical & Vacuum Machinery Co., Inc., Buffalo, N. Y., as president of that company.

J. L. WILLIAMSON, formerly with the General Electric Co., Schenectady, N. Y., is now a research engineer with the Fellows Gear Shaper Co., Springfield, Vt.

WINFIELD H. SMITH, machinery manufacturer, announces the removal of his factory from 10-16 Lock St., Buffalo, N. Y., to Springville, N. Y. A Buffalo office will still be maintained at the old address.

DANIEL J. REAGAN has been appointed trade commissioner at Paris for the Department of Commerce. Mr. Reagan was formerly with the McGraw-Hill Co.

GEORGE DURELL of the American Fork & Hoe Co., Cleveland, has purchased the leasehold and buildings of the L-M Axle Co., Cleveland, and will operate the company in the future.

OSCAR S. TYSON and L. W. SEELIGSBERG have incorporated O. S. Tyson & Co., Inc., to conduct an advertising agency with offices in the Hudson Terminal Building, 50 Church St., New York. Mr. Tyson, president of this organization, recently resigned as vice-president of Rickard & Co. Mr. Seeligsberg, vice-president and treasurer of the new company, has for the past year been operating an agency under his own name. He was formerly business manager of several of the McGraw-Hill publications.

CHARLES O. LAVETT, for many years associated with the Buffalo Foundry & Machinery Co., as engineer in charge of tests and field erection, is now associated with the Chemical & Vacuum Machinery Co., Inc., as manager of that company.

Black & Decker Co. Holds Mechanical "Clinic"

The Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md., recently held an interesting meeting of sales managers and salesmen at the home office at which time the men were given full instructions in the use of all of the products of the company. These meetings were called "clinics" and a certain proficiency was required from each man present. At the completion of the instruction a contest was run with two prizes offered for the men who performed a certain operation with the electric screw driver in the shortest space of time and with the best quality of workmanship.

Besides these working demonstrations, meetings were held each evening for the purpose of formulating definite merchandising plans for increasing sales. A new data book was also distributed to the salesmen.

Machinery Exports in July

Exports of metal-working machinery during July, with revised comparative figures for July of last year, as compiled by the Department of Commerce, are as follows:

	July	
	1923 Value	1924 Value
Lathes	$96,780	$141,192
Boring and drilling machine tools	67,505	74,381
Planers, shapers and slotters	32,470	24,468
Bending and power presses	19,030	23,791
Gear cutters	20,371	27,299
Milling machines	17,913	40,271
Thread cutting and screw machines	27,913	43,075
Punching and shearing machines	16,666	6,206
Power hammers	20,005	20,175
Rolling machines	6,010	3,538
Sharpening and grinding machines	87,102	.....
External grinding machines	.....	71,270
Internal grinding machines	.....	19,637
Other grinding and sharpening machines	.....	46,279
Chucks for machine tools	36,504	13,357
Reamers, cutters, drills, taps, dies, other metal-working tools	220,867	148,260
Pneumatic portable tools	54,946	62,731
Foundry and molding equipment	26,362	49,099
Other metal-working machinery and parts of	392,209	290,997

Trade Catalogs

Twist Drills. The Cleveland Twist Drill Co., Cleveland, Ohio. Speed and feed tests with the Cleveland twist drill have been made and, according to the company, world's records have been established. Drilling in cast iron and machinery steel were two of the tests in which records were made. A little booklet recently sent out by the company contains the story of the competition.

Chains. The Morse Chain Co., Ithaca, N. Y. "A Chain of Evidence" is the title of a new booklet in which the many users of Morse chains are enumerated and illustrations show the chains in various plants in different parts of the country. A surprisingly large number of different styles of chain is to be found.

Cranes. The Cleveland Crane & Engineering Co., Wickliffe, Ohio. This folder describes the steel mill crane and the gantry crane for yard service that this company make. Both cranes are illustrated and the description matter is well prepared.

Axles. The Sheldon Axle & Spring Co., Wilkes-Barre, Pa. The Huck axle and its application to motor trucks is illustrated and described in a booklet just out. Specifications, the results of tests, and other interesting data is to be found.

Heaters. The Buffalo Forge Co., Buffalo, N. Y. Unit heaters for the shop are described in this folder and illustrations show that the heater is compact, easily moved from one place to another, and constructed strongly.

Tapping Machines. The Geometric Tool Co., New Haven, Conn. The Jarvis high-speed tapping devices and appliances with instructions for operating are listed and described. All necessary specifications and classifications are included in the booklet.

Boring Machines. The Ingersoll Milling Machine Co., Rockford, Ill. A folder showing the vertical angular housing cylinder boring machine that is made by this company. Three illustrations adequately show the machine to advantage, while the boring bars and cutters are shown in two separate illustrations.

Ventilating Fans. The American Blower Co., Detroit, Mich. Fans, blowers and ventilators are described and the principle of the double inlet is expounded. Capacity tables for various conditions are contained in the booklet.

Reamers. The Conradson Tool Corp., 2539 Woodward Ave., Detroit, Mich. The product of this company is shown in a four-page folder recently issued. Reduction of reamer costs is stressed and the Conradson method is explained. Several illustrations show the parts and assembled reamers.

Porous Plates. The Norton Co., Worcester, Mass. Plates used for large scale filtering in the chemical, metallurgical and electro-chemical field are minutely described and illustrated. The grades, heat resistance, capillarity, porosity, and shapes are taken up and discussed.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Transformers and extra switch gears and other gears for equipment of transformer stations. Hankow, China. Purchase. Reference No. 11,433.

Machine tools. Rangoon, India. Purchase and agency. Reference No. 11,494.

Metallurgical machinery, furnaces, appliances, pyrometers, and other instruments. Melbourne, Australia. Agency. Reference No. 11,443.

Woodworking machines and machine tools. Basel, Switzerland. Purchase and agency. Reference No. 11,448.

Forthcoming Meetings

International Railway General Foremen's Association. Annual convention, Sept. 9, 10, 11 and 12. Hotel Sherman, Chicago, Ill. William Hall, 1061 W. Wabash Ave., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fourth annual machine tool exhibit, Sept. 15-18. Mason Laboratory, New Haven, Conn. H. R. Westcott, chairman.

Franklin Institute. Centenary celebration of the founding. Philadelphia, Sept. 17, 18 and 19. The Hall of Franklin Institute, 15 S. Seventh St. Gellert Alleman, chairman of the executive committee.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

National Association of Cost Accountants. Annual convention, Springfield, Mass., Sept. 22, 23, 24 and 25. S. C. McLeod, secretary, 130 W. 42nd St., New York City.

National Safety Council. Thirteenth Annual Safety Congress. Louisville, Ky. Sept. 29 to Oct. 3. W. H. Cameron, managing director, 168 N. Michigan Ave., Chicago.

Motor and Accessory Manufacturers' Association. Annual meeting, Cleveland, Ohio. Week of Oct. 6, 1924.

American Foundrymen's Association. Twenty-eighth annual convention. Milwaukee, Wis. Week of Oct. 13, 1924.

National Industrial Advertisers Association. Annual meeting, Edgewater Beach Hotel, Chicago, beginning Oct. 13, 1924.

Management Week. Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. Simultaneously held in leading cities.

American Gear Manufacturers Association. Semi-annual fall meeting. Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 16, 17 and 18. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Production meeting. General Motors Building, Detroit, Mich., Oct. 22, 23 and 24. C. S. Clarkson, secretary.

American Society of Mechanical Engineers. Forty-fifth annual meeting. New York City. Dec. 1 to 4. Calvin Rice, secretary, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York City, Dec. 1 to 4. Charles F. Roth, 1102 Grand Central Palace Building, New York City.

Exposition of Invention. Engineering Societies Building, 29 West 39th St., New York City. Dec. 8 to 13 inc., General offices, 47 West 34th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Improvement in pig-iron inquiry. No. 2 fdry. Southern remains at $18 per ton, Birmingham, as against $25@$27 one year ago. Production is increasing in both iron and steel. Structural steel bookings show gains. Most of the steel demand is from the railroads; orders consisting largely of rails, car and bridge materials. Structural shapes are slow. Buying is better in black and galvanized sheets. Bars are $2.10@$2.15 per 100 lb., Pittsburgh; shapes, $1.95@$2.10 and plates, $1.70@$2. Quotations are the same as last week with the exception of slight weakness in shapes.

Non-Ferrous Metals—Foreign tin and copper prices down. Copper firmer in domestic market; tin steady. Lead firm at present levels. Zinc down $1 per ton since Aug. 28. Antimony firmer, due to reports of war in China.

(All prices as of Sept. 5)

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$22.05@22.55
Northern Basic	20.00
Southern Ohio No. 2	21.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.05
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.77@23.27
Virginia No. 2	28.44@29.44
Basic	20.00@21.00
Grey Forge	21.00@22.00
CHICAGO	
No. 2 Foundry local	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	28.05
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	28.66

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.65@2.70	3.89	3.55	3.80
No. 12	2.75@2.80	3.94	3.60	3.95
No. 14	2.85@2.90	3.99	3.65	4.00
No. 16	3.05@3.10	4.09	3.75	4.10
Black				
Nos. 17 and 21	3.35	4.40	4.25	4.55
Nos. 22 and 24	3.40	4.45	4.30	4.55
Nos. 25 and 26	3.45	4.50	4.35	4.60
No. 28	3.50	4.60	4.45	4.50
Galvanized				
Nos. 10 and 11	3.60	4.60	....	4.60
Nos. 12 and 14	3.70	4.70	....	4.70
Nos. 17 and 21	4.00	5.00	....	5.00
Nos. 22 and 24	4.15	5.15	5.00	5.15
No. 26	4.30	5.30	5.25	5.30
No. 28	4.60	5.60	5.55	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	56%	43%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	7.50	8.00	6.55
Hoop steel	4.49	3.96@4.36	4.15
Cold rolled strip steel	7.00	8.25	7.15
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.21	3.10
Soft steel bars (base)	3.24	3.11	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.61	3.65
Tank plates (base)	3.34	3.43½	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Tool steel	11.00	....	....
Drill rod (from list)	60%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.37½
Tin, 5-ton lots, New York			53.12½@53.25
Lead (up to carlots), St. Louis 8.00	New York		8.62½@8.75
Zinc (up to carlots), St. Louis. 6.25	New York		7.00@7.25
	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.10	28.00	28.50
Antimony (Chinese), ton spot	11.50	13.00	10.00
Copper sheets, base	20.62½	20.87½@21.25	23.00
Copper wire, base	19.00	19.00	21.75
Copper bars, base	19.87½	22.25	22.50
Copper tubing, base	22.75	28.00	25.75
Brass sheets, base	17.25	21.75	19.75
Brass tubing, base	21.50	28.00	28.25
Brass rods, base	15.00	17.75	17.50
Brass wire, base	17.75	21.75	20.25
Zinc sheets (casks)	10.60	11.10	....
Solder (½ and ½), (case lots)	38.50	35.00	30.00
Babbitt metal (83% tin)	60.00	61.75	48@52
Babbitt metal (35% tin)	28.00	18.50	23@26
Nickel (ingot and shot) f.o.b. refinery	27.00	....	....
Nickel (electrolytic) f.o.b. refinery	30.00	....	35.00
Nickel (F shot) f.o.b. refinery	30.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54.00
Manganese nickel hot rolled rods "D"—high manganese (base) 57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	10.75@11.25	....	9.50@10.00
Copper, heavy, and wire	10.50@11.00	....	11.00
Copper, light, and bottoms	9.25@9.75	....	8.00@8.25
Heavy lead	6.25@6.75	....	5.00@5.50
Tea lead	5.25@5.75	....	3.00@3.25
Brass, heavy, yellow	6.75@7.00	....	6.00
Brass, heavy, red	8.50@8.75	....	7.50
Brass, light	5.75@6.00	....	5.00
No. 1 yellow rod turnings	7.25@7.75	....	6.00
Zinc	3.75@4.00	....	4.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.00	12.75
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.75	6.55	6.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.14½	.17	.10½
Wiping cloths, 13¼x13¼, per lb	11@11.25*	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.	....	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.07	1.16	1.05
Lard cutting oil, 25% lard, per gal.	.55	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber transmission:			
First grade	50%	50–10%	40–10%
Second grade	50–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	$6.48
Emery paper	10.71	11.00	8.80
Emery cloth	28.00	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag	....	.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.00@3.25
Coke, prompt foundry, Connellsville	per net ton		4.25@4.75
White lead, dry or in oil	100 lb. kegs		New York, 14.75
Red lead, dry	100 lb. kegs		New York, 14.75
Red lead, in oil	100 lb. kegs		New York, 16.25

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	0.0415	0.0415	0.0465
Brass rods	per lb	0.15	0.145	0.1675
Solder (½ and ½)	per lb.	0.385	0.375	0.295
Cotton waste	per lb.	.14@.21	.14@.21	10@13
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	0.55	0.55	0.55
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	50%	50%	40–10%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	60–10–5%	60%
1½ and 1¼x3 in. up to 12 in.	15%	.....	....
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	40%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	3.50 net	60%*
Button head bolts, with hex. nuts	10%	List net	.....
Hex. head and hex. nut bolts	10%	.....	.....
Lag screws, coach screws	50%	.....	65%
Square and hex. head cap screws	75%	75%	.....
Carriage bolts, up to 1 in. x 30 in.	40%	60%	55%
Bolt ends, with hot pressed nuts	50%	.....	60%
Tap bolts, hex. head, list plus	35%	.....	$4.65
Semi-finished nuts, ⅜ and smaller	70%	.....	.....
Semi-finished nuts, ½ and larger	65%	70%	.....
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.75
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	3.75
Washers, round plate, per 100 lb. Off list	1.50	4.50	4.50
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	4.00	4.00
Rivets:			
Rivets, ⅞ in. dia. and smaller	50%	60–10%	70%
Rivets, tinned	50%	60–10%	70%
Button heads ⅝-in., ¾-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.50	$3.50
Cone heads, ditto (net)	5.20	3.60	3.70
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.35	.....	0.15
¾ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	....

*Square.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., New Haven—Biever Motor Co., 1079 Chapel St.—miscellaneous machinery for garage and service station.

Ill., Chicago—L. A. Kamradt, 3441 North Hamlin Ave.—shapers, milling machines, drill press, drills, taps, etc.

Mass., Boston—International Harvester Co., 63 North Beacon St.—equipment for large garage and automobile repair shop.

Mass., Chelsea, (Boston P. O.)—School House Comn.—metal and woodworking machinery for Manual Training Dept. in new High School.

Mass., East Cambridge—(Boston P. O.)—Peter Gray & Sons, Inc., 286 Third St.—tumbling barrel about 30 inches in diameter, 4 to 5 ft. long.

Mass., East Cambridge (Boston P. O.)—Viscol Co., 200 First St.—circular cutter with 4-foot radius to cut sheet iron up to 16 gage, shaper and vise, stroke about 12 in. and drill press, 3 or 4 with table about 20 in. x 26 in.

Mass., Marlboro—T. A. Lynch, 87 Howland St.—modern portable steam sawmill, complete equipment.

Mass., Medford — Schoolhouse Bldg., Comn., C. H. Lowell, Chn.—equipment for manuel training department, including woodworking and metal for new Junior High School.

N. J., North Plainfield—Aacone Engineering Corp., Steiner Pl.—complete brass rolling mill, motor driven (new or used).

N. Y., Brooklyn—Jimmerson and Gough, 174 Fulton St.—bending machine for 3 in. pipe.

O., Canton—Timken Roller Bearing Co., J. P. Moriarty, purch. agt.—machinery for new $500,000 rolling mill.

O., Massillon—Shafer-Hammond Lumber Co., C. M. Shafer, pres.—woodworking equipment for mill.

Okla., Sand Springs—The Pierce Oil Corp.—lathes, drills and miscellaneous tools for new machine shop.

Ore., Portland—Port of Portland, 916 Spalding Building, J. H. Polhemus, Gen. Mgr. and Ch. Engr., general utility emery grinder; back geared shaper complete, medium size; 2 in. single head bolt cutter & threader; 24 in. x 48 in., gap lathe; 42 in. plain radial drill with 20 in. back, geared wheel & lever.

R. I., Newport—Manuel Bros., Cherry St.—wood saw and table with or without motor.

Tex., Dallas—Del Ramey Electric Co., 2428 Commerce St.—small lathe, electric grinder, etc.

Tex., Lewisville—T & H Motor Co.—ram and power press, one ton circular hoist, automatic compressor, etc.

Wis., Algoma—Swoboda Church Furniture Co.—woodworking machinery.

Wis., Oconto—Oconto Co., E. M. McAllister, Highway Comr.—drill press, grinder, possibly a lathe.

Wis., Milwaukee—A. Eldred, 339 1st Ave.—large power saw, band saw.

Wis., Milwaukee—Guaranteed Gear Service Co., 208 Wells St., P. E. Kichartz, purch. agt.—medium size lathe, drill press.

N. S., West Middle River, Victoria Co., Cape Breton—M. W. MacRae—complete portable sawmill.

What This Section Is

Machinery Requirements and Industrial Construction is a reliable machinery market, because every item is reported first-hand by our own correspondents, scattered over the United States and Canada. These leads are verified by our men. We do not use newspaper clippings, nor do we listen to any hearsay or rumors. These sales leads are as accurate as our men can make them, and as timely as weekly publication will permit.

This market is for *American Machinist* subscribers. It covers the same machinery fields as does the paper. Here willibe found inquiries for machine tools, presses, hammers, welding, forging and heat treating equipment, wood working machinery, cranes, hoists and other material handling machinery for the shop.

Here also will be found reports of proposed industrial construction, where sooner or later machinery will be needed.

Are you making the most of the opportunities listed here?

Ont., Carp — Gamble Bros. — complete equipment for new public garage and repair shop.

Ont., Kentvale — F. B. Kent — saws, edgers, planter etc., electric or steam power for sawmill.

Ont., Renfrew—Kelly and Graham—lathe, drill press and other repair shop equipment.

Ont., Windsor — Auto Specialties Co., Tecumseh Road—additional metal working equipment, including stamps, dies, polishing machinery etc.

Que., Montreal—Mde. J. Kornmair & Co., 462 St. Hubert St.—complete equipment for new automobile repair shop.

Que., Montreal—G. Morann, 252 City Hall Ave.—complete equipment for new garage and automobile repair shop.

Opportunities for Future Business

Conn., Hartford—National Iron Works, 710 Windsor St., plans the construction of iron works plant, estimated cost to exceed $40,000.

Conn., New Haven—Biever motor Co., 1097 Chapel St., is receiving bids for the construction of a 1 story, 50 x 150 and 70 x 140 ft. public garage service station, etc., estimated cost, $150,000. R. W. Foote, 185 Church St., Archt.

Ind., Crown Point—Commings Vote Registering Machine Co., plans the construction of plant, estimated cost $350,000.

Mass., Dorchester (Boston P. O.)—Stilphen Co., 395 Columbia Road, plans the construction of a 1-story, repair and service garage at 450 Columbia Road, estimated cost to exceed $40,000.

Mass., Dorchester—G. V. Wattendorf, 699 Columbia Road, plans the construction of a 1-story service and repair garage at Edward Everett Sq., estimated cost, $60,000.

Mass., Everett—Mystic Iron Works, 1 Federal St., Boston, is receiving bids for superstructures for factory buildings. Total estimated cost $5,000,000. Fine & Bassett, Chicago, engineers.

N. Y., New York—Coca Cola Bottling Co., 138 East 54th St., is having plans prepared for the construction of a 3 story, 60 x 200 ft. garage and plant at East 46th St., estimated cost, $200,000. Euel & Euel, 154 Nassau St., engrs.

Okla., Sand Springs—The Pierce Oil Corp plans improvements to plant, including machine shop, estimated cost, $2,000,000. Private plans.

R. I., Pawtucket—Dutee Wilcox Flint, Inc., Allens Ave., Providence, plans the construction of a 1-story, 70 x 200 ft. auto repairing station on Main and Pine Sts., estimated cost, $40,000.

Tex., Houston — Texas Barrel Works, Vance St., is having plans prepared for the construction of a cooperage plant, estimated cost, $50,000.

Wis., Algoma—Swoboda Church Furniture Co., is receiving bids for the construction of a 2-story, 50 x 120 ft. factory. Private plans.

Wis., Appleton—Seamless Steel Tube Co., Spencer and Story Sts., plans the construction of a 1-story, 60 x 150 ft. mill, estimated cost $50,000.

Wis., Green Bay—J. Kittell, Bellin Bldg., awarded the contract for the construction of a 3 story, 66x100 ft. garage, estimated cost, $150,000.

Wis., Oconto—Oconto Co., E. M. McAllister, Highway Comr., will build a 1-story, 42 x 60 ft. machine shop, estimated cost, $40,000.